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Integrated Icing Diagnostic Algorithm (IIDA) Assessment at Regional Airlines Final Report

Danny Sims
Thomas Carty

September 2000

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16. Abstract

This report summarizes the Integrated Icing Diagnostic Algorithm (IIDA) Assessment conducted by ACT-320 at Atlantic Coast Airlines and Air Wisconsin from September 1998, through May 1999.

The IIDA, developed by scientists at the National Center for Atmospheric Research (NCAR), combines a number of in-flight icing detection techniques into an integrated algorithm that makes use of the strengths of each technique. The algorithm output consists of three dimensional grids of Icing Potential and Supercooled Large Drop Potential, augmented by several intermediate products to aid in assessing in-flight icing conditions.

Feedback was collected from airline dispatchers and focused on the utilitity and perceived benefit of IIDA, along with suggested enhancements for dispatcher use.

Assessment results indicated that IIDA was useful to airline dispatch operations, with the potential to be used for several dispatcher job task areas. It was recommended that IIDA be considered for adoption as an official aviation weather product.

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EXECUTIVE SUMMARY

This report summarizes the Integrated Icing Diagnostic Algorithm (IIDA) Assessment conducted at Atlantic Coast Airlines and Air Wisconsin from September 1998 through May 1999. Specific results, conclusions, and recommendations for the assessment are detailed within this report.

The Research Applications Program at the National Center for Atmospheric Research (NCAR/RAP) has developed the IIDA by combining a number of icing detection techniques into an integrated algorithm that makes use of the strengths of each technique while simultaneously minimizing individual weaknesses. The IIDA makes use of satellite imagery, numerical weather prediction model output, radar reflectivity mosaic, and surface weather observations. The algorithm output consists of three-dimensional grids of Icing Potential and Supercooled Large Drop (SLD) Potential, augmented by several derived intermediate products to aid in assessing icing type and meteorological conditions associated with the icing.

The assessment was conducted by the Federal Aviation Administration (FAA) William J. Hughes Technical Center, Weather Branch (ACT-320) using airline dispatchers at Atlantic Coast Airlines and Air Wisconsin. The assessment focused on the utility and perceived benefit of IIDA, along with suggested enhancements for dispatcher use. Feedback was collected via an Internet-based User Log, observations and interviews of dispatchers by ACT-320 personnel, and an Internet-based Final Questionnaire.

Assessment results indicated that IIDA was useful to airline dispatch operations, with the potential to be used for flight planning, flight release preparation, payload decisions, monitoring of flight conditions, and the use of aircraft with inoperable equipment. Of all the IIDA components, the Icing Potential product viewed in a vertical cross section provided the most value. The vertical cross section graphically displayed point-to-point information, covering all phases of flight in one quick look.

Dispatchers perceived IIDA to be an accurate product for identifying the existence and absence of in-flight icing conditions, indicating Icing Potential as the most accurate IIDA component. However, a tendency to over forecast was noted in the Midwest and Rocky Mountain regions.

Overall, the IIDA human computer interface was found to be acceptable, although issues associated with differentiating various shades and interpretation of red areas of the display were identified.

The most frequently suggested product enhancements included the addition of icing intensity, animation, and a 1- to 6-hour forecast. Other identified enhancements (reported less frequently) included additional overlays, user selected routes, automatic updates, user selected zoom function, Pilot Report (PIREP) text information, and inclusion of IIDA into an Aircraft Situation Display.

Based upon the assessment results, ACT-320 recommends that IIDA be considered for adoption as an official aviation weather product. The product should take the form of an Icing Potential product viewable in a vertical cross section, along with PIREP information. However, before IIDA is considered for adoption as an official product, certain issues involving the tendency to over forecast, Internet training, and the use and understanding of SLD need to be addressed. In addition, further IIDA development should focus on possible animation of the Internet-based product, the inclusion of icing severity, and a 1- to 6-hour forecast capability.

1. INTRODUCTION.

1.1 BACKGROUND.

The Research Applications Program at the National Center for Atmospheric Research (NCAR/RAP), under sponsorship by the Federal Aviation Administration (FAA) Aviation Weather Research Program (AWRP), has conducted research and development activities for improvement of in-flight icing detection and forecasting. Significant progress has been made in developing icing algorithms to apply to operational model output, using multi-spectral satellite data for detection of super cooled liquid at cloud top, combining surface observations and model outputs to diagnose super cooled large drop (SLD) conditions, and developing microphysical parameterizations for numerical weather models. To date, most of the icing diagnosis work has utilized single instruments or models. By themselves, these techniques are not adequate to diagnose icing conditions in every possible case. Each technique has its own strengths and weaknesses. A possible method of providing an improved icing diagnosis is to combine a number of techniques into an integrated algorithm that makes use of the strengths of each while simultaneously minimizing individual weaknesses. NCAR/RAP has used "fuzzy logic" techniques for this sort of integration. This approach is being pursued for the development of the Integrated Icing Diagnostic Algorithm (IIDA).

The IIDA makes use of satellite imagery, numerical weather prediction model output, national radar data, and routine surface weather observations. The algorithm output consists of a three-dimensional (3-D) grid of icing potential, augmented by several intermediate products to aid in assessing icing conditions. The product provides an hourly diagnostic for real-time in-flight icing conditions.

An initial assessment of the IIDA was conducted at the Aviation Weather Center (AWC) from March through May 1998. Personnel from the FAA William J. Hughes Technical Center Weather Branch (ACT-320) conducted the assessment by collecting feedback from AWC Area forecasters with regard to IIDA utility, reliability, and accuracy. Results of that assessment were documented and provided to NCAR/RAP for further IIDA development. A report is available from ACT-320.

For the winter 1998-1999 seasons, an assessment of IIDA was conducted at two regional airlines: Air Wisconsin and Atlantic Coast Airlines. Regional airlines' needs are often overlooked in the design and implementation of new weather products and tools despite the fact that regional air traffic accounts for a significant number of air travelers. Icing is especially problematic for these airlines, given that a greater percentage of their aircraft fly at lower altitudes where icing is prevalent. Regional jets now entering service for these companies may also fly lower on short-haul routes, exposing them to the same in-flight icing hazard as propeller-driven aircraft. It is envisioned that a product like IIDA may be of benefit to regional airlines, which often have few reliable information sources and little or no available on-site meteorological expertise. Thus, the 1998-1999 IIDA assessment focused on regional airlines to determine the utility and perceived benefit of IIDA, as well as suggestions for enhancements.

1.2 PURPOSE OF REPORT.

The purpose of this report is to document activities, results, conclusions, and recommendations from the IIDA Assessment conducted at the regional airlines during the winter 1998-1999 season. This report will be provided to NCAR/RAP to assist with future development of the

IIDA. NCAR/RAP is conducting separate IIDA verification activities to measure the meteorological accuracy of the product, and will be responsible for issuing results on their verification work.

2. REFERENCE DOCUMENTS.

a. Acquisition Management System Test and Evaluation Process Guidelines, FAA, June 1999.

b. Assessment Plan for the Integrated Icing Diagnostic Algorithm (IIDA) at Regional Airlines, FAA Technical Center and NCAR, November 10, 1998.

c. Integrated Icing Diagnostic Algorithm (IIDA) Assessment Report, FAA Technical Center, December 4, 1998.

3. PRODUCT OVERVIEW.

The IIDA integrates various data sources and provides a diagnosis of the potential for in-flight icing. Specific inputs, outputs, and hardware are described in the following sections.

3.1 IIDA COMPONENTS.

The IIDA uses the following data inputs:

a. Geostationary Orbiting Environmental Satellite (GOES)-8 multi-spectral satellite imagery;

b. Temperature, Relative Humidity, and Geopotential Height from the National Centers for Environmental Prediction (NCEP) Rapid Update Cycle (RUC) model;

c. Next Generation Weather Radar (NEXRAD) reflectivity mosaic (NEXRAD Information Dissemination Service [NIDS] vendor product);

d. Surface observations from National Weather Surface (NWS) Aviation Routine Weather Reports (METARs), including cloud coverage, ceiling height, and precipitation type.

The IIDA output consists of:

a. 3-D grids of Icing Potential, scaled from 0 (no icing) to 100 (icing very likely). Icing Potential only indicates the likelihood of encountering in-flight icing. No information on the severity of icing is provided.

b. 3-D grids of SLD Potential, scaled from 0 (no SLD icing) to 100 (SLD icing very likely) or SLD Potential Unknown. SLD Potential indicates the likelihood of encountering SLD conditions. A value of "unknown" is given when IIDA indicates that some icing potential exists in a given location, yet no information is available to properly diagnose the SLD potential.

c. 3-D first guess grids of Icing Type, scaled from 0 (rime) to 75 (mixed) to 100 (clear).

The IIDA data fields are scaled to match the standard RUC data grid (40 kilometers (km) in the horizontal), with output produced on an hourly basis. The primary output grids are augmented by several derived intermediate products in the form of two-dimensional (2-D) gridded data fields intended to aid in assessing in-flight icing. The intermediate 2-D products are:

a. Height of Cloud Bases,
b. Height of Cloud Tops,
c. Height of Icing Bases,
d. Height of Icing Tops,
e. Height of SLD Bases,
f. Height of SLD Tops.

The 2-D height products were color-coded indicating the bases or tops (i.e., the lowest and highest altitudes at which clouds, icing, or SLD were indicated) in thousands of feet.

Many products that were not explicitly IIDA output were also made available to users. These products include:

a. Graphical presentation of any precipitation, freezing precipitation, and snow determined by surface observations;

b. Graphical presentation of precipitation type and cloud cover based upon surface observations;

c. National radar mosaic;

d. Visible and Infrared satellite images; and

e. Web page links to graphical and textual NWS surface observations and forecasts.

For the 1998-1999 winter season, the IIDA products were exclusively a diagnosis of the real-time conditions; there was no forecast capability. NCAR/RAP has developed separate experimental forecast products, however, they were not the focus of this assessment.

3.2 HARDWARE SYSTEM.

The IIDA software ran at NCAR/RAP on a Sun Ultra Sparc 1 workstation. Output grids and intermediate products were produced hourly and placed on the NCAR web server. Regional airlines accessed IIDA via the Internet using the web address of http://www.rap.ucar.edu/largedrop/integrated/regional.html. Regional airline dispatchers viewed IIDA on dedicated personal computers located in the dispatcher work areas. Three personal computers were provided to each regional airline by NCAR/RAP.

3.3 PRODUCT DISPLAY.

The IIDA display allowed the user to select from the various IIDA products. The Icing Potential and SLD Potential fields were available for viewing at discrete flight levels (i.e., 3000; 6000; 9000; 12,000; 15,000; 18,000; 21,000; 24,000; 27,000; and 30,000 feet); in a horizontal plan view composite (e.g., see figure 1); or in a vertical cross section along one of the predetermined Atlantic Coast Airlines and Air Wisconsin routes (e.g., see figure 2). Icing pilot reports

(PIREPs) were plotted on both plan view and vertical cross sections, in addition to being available in separate plan views. The vertical cross section also displayed a Visible Moisture field, which depicted areas of cloud and precipitation below a temperature threshold of 10°C. All other products were only available in horizontal plan views.

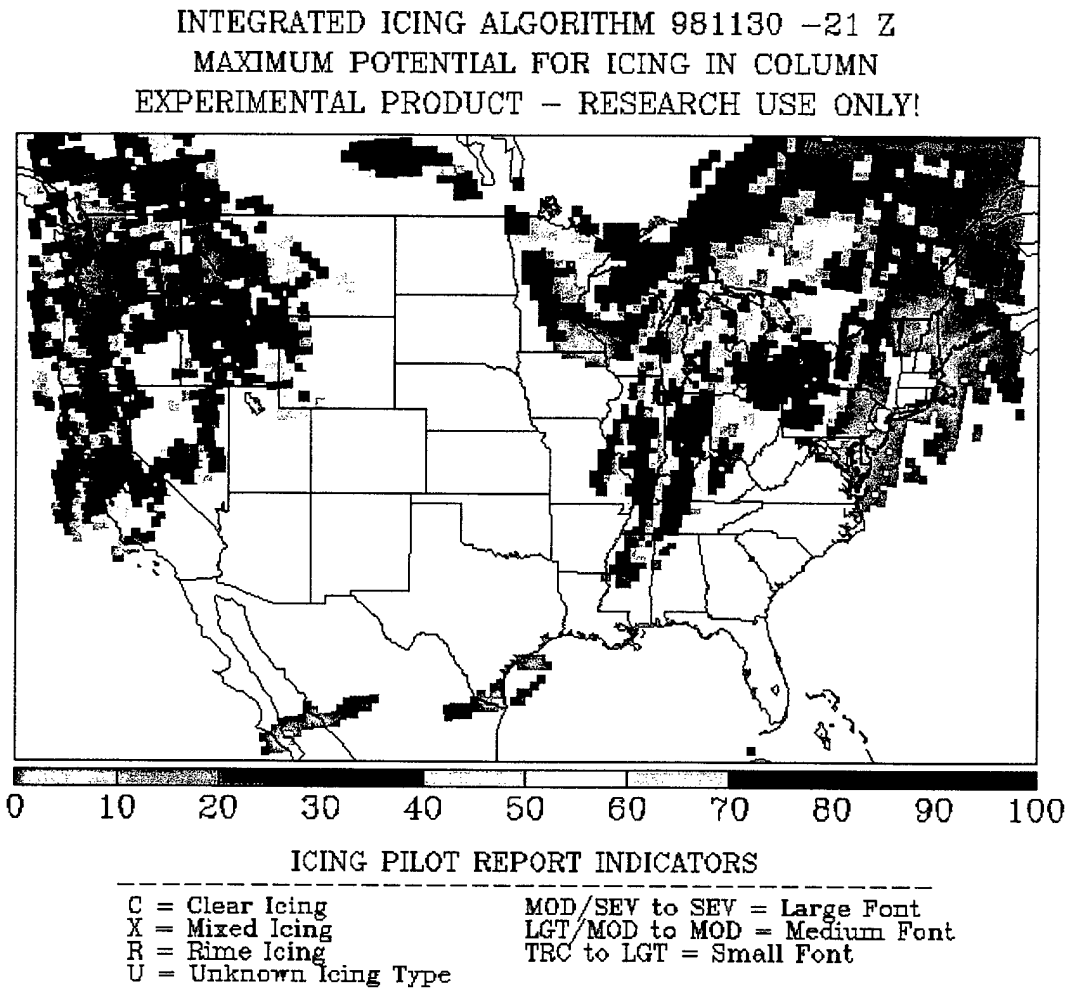

FIGURE 1. HORIZONTAL PLAN VIEW OF COMPOSITE ICING POTENTIAL

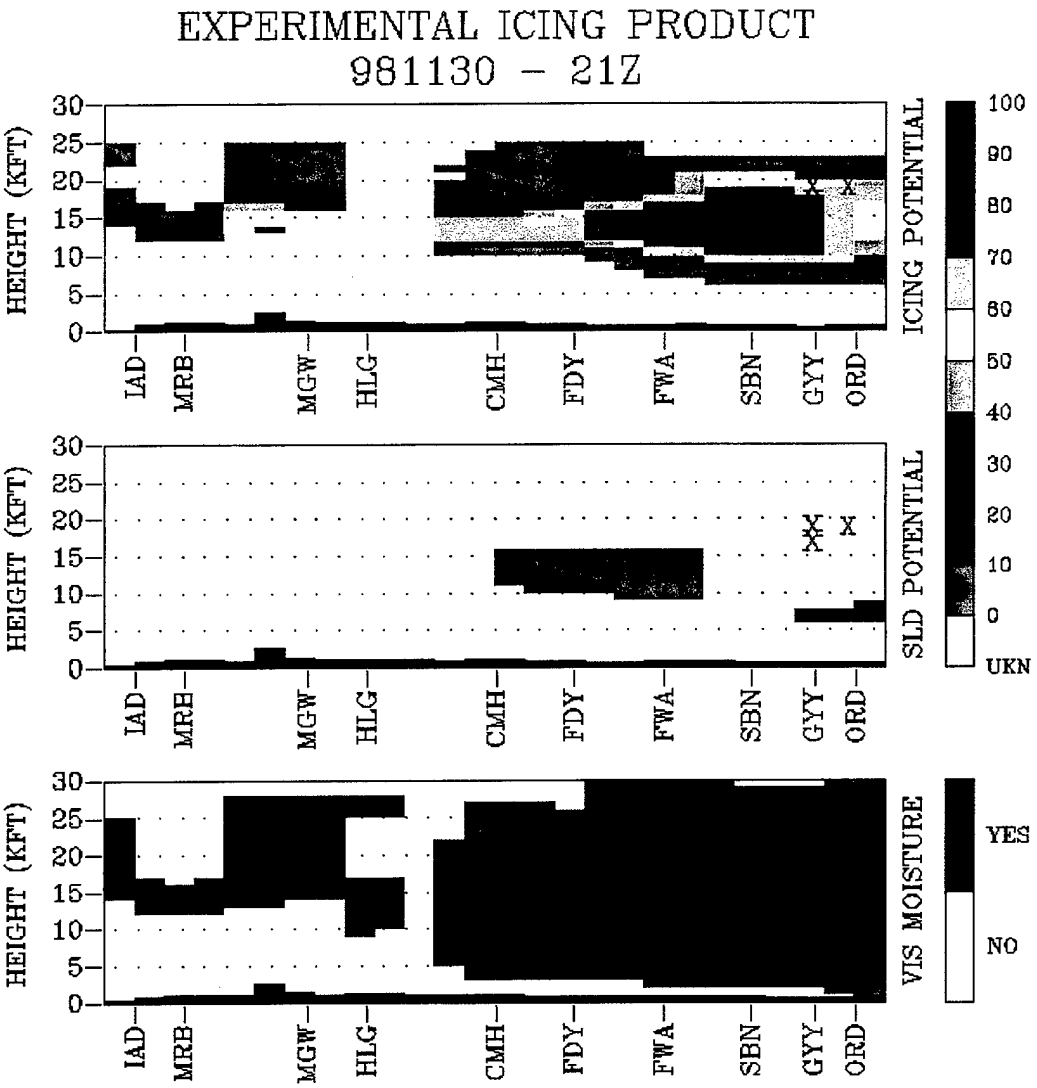

FIGURE 2. VERTICAL CROSS SECTION OF ICING POTENTIAL, SLD POTENTIAL, AND VISIBLE MOISTURE (TOP TO BOTTOM) FROM IAD TO ORD

4. ASSESSMENT DESCRIPTION.

4.1 ASSESSMENT SCHEDULE AND LOCATION.

The IIDA Assessment was conducted from September 1998, through May 1999. During this period, formal feedback was collected from Atlantic Coast and Air Wisconsin Airlines dispatchers through a variety of data collection tools. The assessment was conducted at the dispatch operations center for each airline. Atlantic Coast's center is near Dulles International Airport, Virginia, and Air Wisconsin's center is located at the Outagamie Regional Airport, Appleton, Wisconsin. Table 1 gives the overall assessment schedule. More detailed information on the various phases of the assessment is given in section 4.5.

TABLE 1. IIDA ASSESSMENT SCHEDULE

Activity	**Date**
Baseline Data Collection	September 23-24, 1998
Product Available	November, 1998
Dispatcher Training	November 12-13 and 19, 1998
Dispatcher Refresher Training	December 28-29, 1998 and January 5-6, 1999
Data Collection	December 30, 1998 through May 5, 1999
User Log Available	December 30, 1998 through March 31, 1999
Interviews and Observations	February 17-18 and March 9-10, 1999
Final Questionnaire	April 20 through May 5, 1999

4.2 PARTICIPANTS.

Two regional airlines, Air Wisconsin and Atlantic Coast Airlines participated in the IIDA Assessment. Airline personnel that used IIDA were aircraft dispatchers. While many dispatcher duties were similar, there were differences between the airlines. Each airline is briefly summarized in the following sections.

4.2.1 Atlantic Coast Airlines.

Atlantic Coast Airlines, based out of Dulles, Virginia, is a regional airline operating as United Express under an agreement with United Airlines. Flights are predominantly along the East Coast with some flights to the Midwest (see figure 3). Atlantic Coast Airlines fleet of aircraft at the time of the IIDA Assessment included 14 Canadair Regional Jets (CRJ); 32 Jetstream 41 (J41); and 29 Jetstream 32 (J32). The CRJ is a jet aircraft that has a ceiling of 41,000 feet; therefore, most of its flight time is spent in non-icing conditions. The J41 and J32 are both turboprop aircraft that operate at lower altitudes, making them more likely to encounter icing conditions.

Atlantic Coast Airlines dispatch operations are divided into teams grouped by aircraft type. Each team is headed by a team leader who is responsible for two to three dispatchers. The dispatchers prepare flight releases for individual aircraft, while the team leader has overall decision responsibility. The team leaders had the majority of access to IIDA during the assessment period. Other dispatchers' use of IIDA was limited.

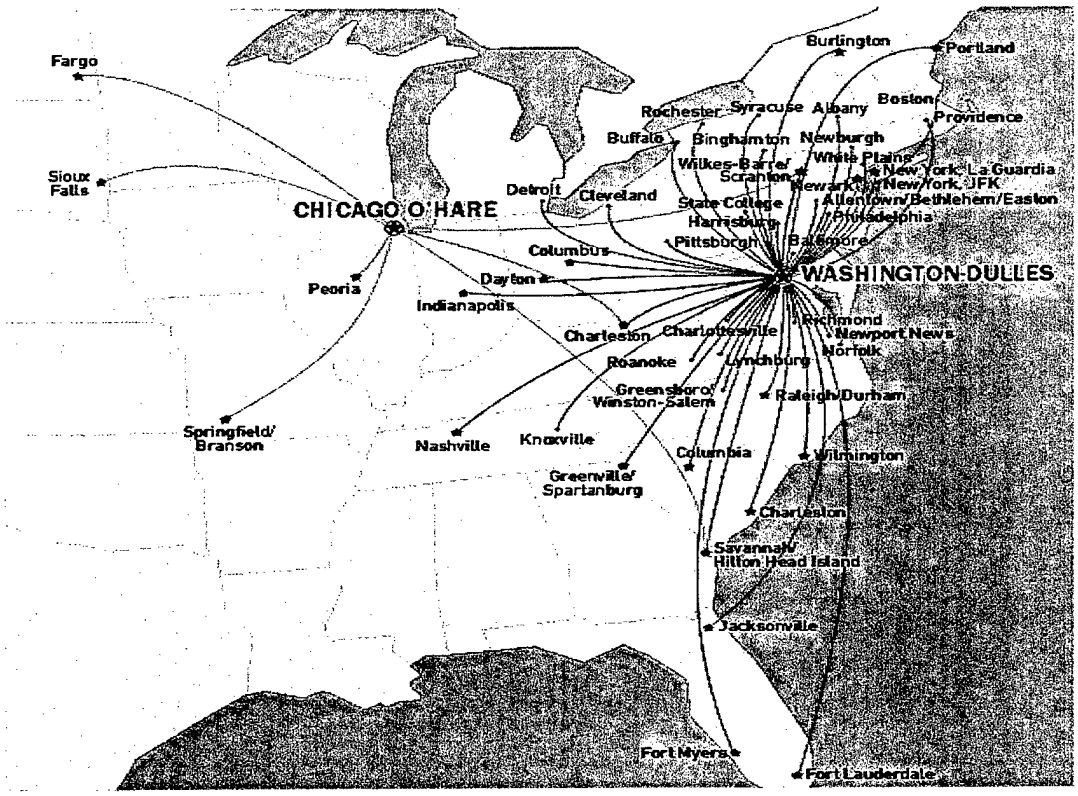

FIGURE 3. ATLANTIC COAST AIRLINES ROUTES

4.2.2 Air Wisconsin.

Air Wisconsin, based out of Appleton, Wisconsin, is also a regional airline operating under an agreement with United Airlines as a United Express airline. Flights are predominantly in the upper Midwest and in the Rocky Mountain region with a hub at Denver, Colorado (see figure 4). At the time of the IIDA Assessment, Air Wisconsin was operating 10 Dornier 328 (328) and 17 Bombardier 146 (146) aircraft. The 328 is a turboprop aircraft that operates in lower altitudes, and in the Rocky Mountain region. It is the aircraft most likely to encounter icing conditions. The 146 is a jet aircraft that operates at higher altitudes and has on-board anti-icing equipment in the form of heated wings that significantly reduce the threat due to in-flight icing. During the assessment period, Air Wisconsin began incorporating CRJs into its fleet. However, due to the newness of the CRJ to operations, personnel associated with it were not included in the IIDA Assessment.

Air Wisconsin dispatch operations are grouped according to aircraft type. One dispatcher is responsible for each aircraft type per shift. In addition, a dispatch coordinator is on each shift overseeing dispatch activities. The dispatch coordinator was not involved in the actual dispatching of aircraft, therefore, their use of IIDA during the assessment was minimal.

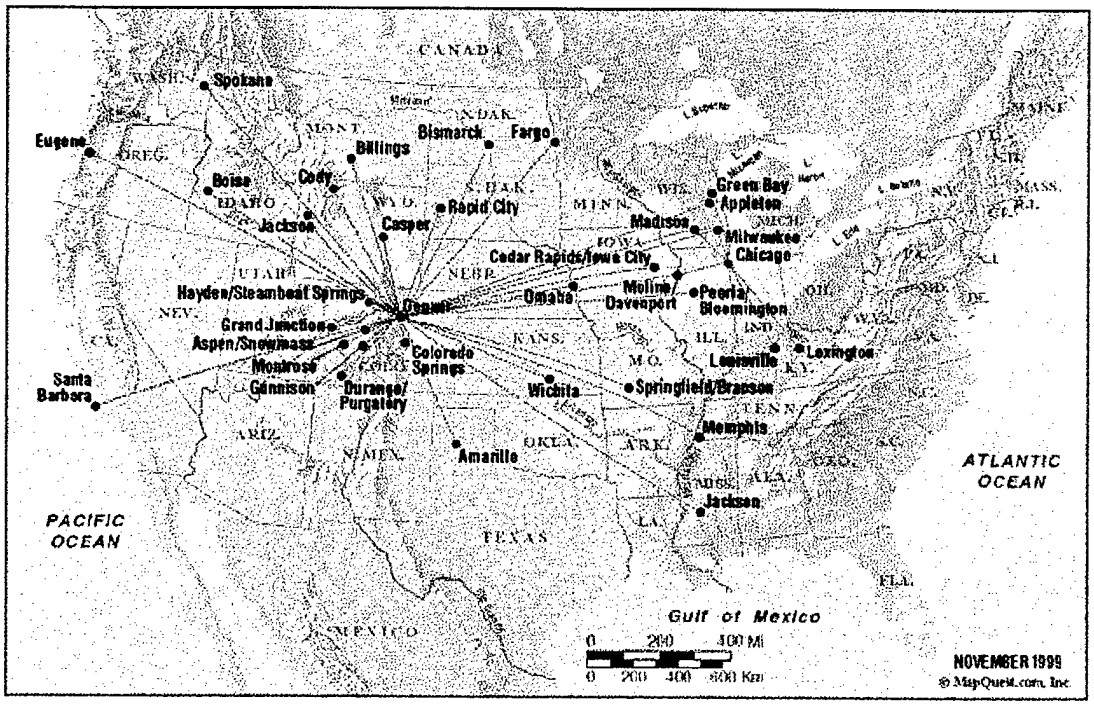

FIGURE 4. AIR WISCONSIN ROUTES

4.3 APPROACH.

The IIDA Assessment consisted of obtaining subjective feedback from regional airline dispatchers. The dispatchers reviewed IIDA output and intermediate fields during normal operational shifts. ACT-320 personnel collected feedback on dispatchers' impressions of IIDA through the use of logs, observations, interviews, and questionnaires. Assessment results were determined from analyzing and summarizing the feedback.

4.4 ASSESSMENT OBJECTIVES.

The objectives of the IIDA assessment were:

a. Determine the utility of IIDA to regional airline dispatchers, including:

1. How is IIDA used to accomplish specific tasks?

2. What other information is needed to accomplish tasks?

3. What components of IIDA appear to provide the most benefit for identifying areas of aircraft icing?

4. Under what situations does IIDA perform well or not perform well;

5. Subjectively identify how IIDA performance compares to current methods used by regional airline dispatchers for identifying areas of aircraft icing.

b. Assess human computer interface issues, such as meaningful color-coding, navigation, access to products, and adequate overlays.

c. Identify potential benefit areas, including how IIDA information alters previous ways of accomplishing a task and the implications.

d. Identify potential enhancements to IIDA.

e. Analyze icing verification information obtained from regional airline flight crew pilot reports via comparisons to IIDA output. (Note that due to the amount of dispatcher resources that would have been required, this objective was deleted from the assessment.)

4.5 ASSESSMENT DESCRIPTION AND METHODOLOGY.

4.5.1 Baseline Measures.

Prior to the start of the official assessment, baseline data collection was conducted. ACT-320 personnel collected baseline data from both participating airlines in order to establish current information sources and dispatcher procedures concerning in-flight icing. The information was collected by conducting observations and interviews of dispatchers in their operational settings. Atlantic Coast Airlines baseline data was collected on September 23, 1998, and Air Wisconsin data was collected on September 24, 1998. Both baseline data collection efforts were conducted before IIDA was available to the dispatchers to avoid biasing the assessment results. Baseline information is included at appendix A.

4.5.2 Training.

Initial training activities were conducted by NCAR scientists. Training materials were developed and presented that covered the physics of in-flight icing and IIDA processes. IIDA displays were utilized as part of the training. Training was conducted predominantly one-on-one, or at the most with three dispatchers at a time. ACT-320 personnel attended the training sessions in order to familiarize themselves with IIDA and to note the information provided to dispatchers. Initial training was provided to Air Wisconsin on November 12-13, 1998, and to Atlantic Coast Airlines on November 19, 1998. While not all dispatchers received initial training, representative samples at both airlines were trained.

Following initial training, the NCWF was allowed to run to ensure product stability and provide additional familiarization for the airline dispatchers. After this period, refresher training was conducted at each airline. Previous ACT-320 evaluation efforts have identified the importance of refresher training to ensure that assessment participants have an adequate knowledge base to provide useful feedback. ACT-320 personnel conducted the refresher training at Air Wisconsin on December 28-29, 1998, and at Atlantic Coast on January 5-6, 1999. NCAR personnel also attended to answer IIDA questions and provide clarification on any points of confusion or misinformation.

4.5.3 User Log.

The collection of formal feedback was initiated through the use of an Internet-based User Log (see appendix B). The log was made available on December 30, 1998, and log feedback was collected until the end of March 1999. The log enabled dispatchers to briefly note any negative

or positive performance aspects of IIDA during day-to-day use. Information from the log was used to identify specific instances of algorithm performance along with the date and time of occurrence. Users were asked to identify job-related functions for which IIDA was referenced and the value of the different IIDA components and existing operational products in identifying in-flight icing. A link from the IIDA web display to the User Log was provided.

4.5.4 Observations and Interviews.

Observations and interviews were conducted by ACT-320 personnel during the middle portion of the assessment in order to record how and under what circumstances IIDA was used and whether other methods were used to detect and forecast icing conditions. The intent of the observations and interviews was to solicit information that was not available within the User Log or a questionnaire format, obtain more detailed information, and obtain clarification on reported problems and benefits. Data from the interview questions was used to provide insight into IIDA issues that were difficult or too time consuming for a user to write down. Observations of airline dispatchers' use of IIDA during actual operations occurred in conjunction with the interviews. ACT-320 personnel used observation logs to record how and under what circumstances IIDA was used, whether other methods were used to identify and forecast in-flight icing, and any additional feedback from the dispatchers. Observations were conducted so as to not interfere with airline operations. Observations and interviews were conducted at Air Wisconsin on February 17-18, 1999, and at Atlantic Coast Airlines on March 9-10, 1999. Seven dispatchers were interviewed at Air Wisconsin. Due to a snowstorm and the resulting impact on flight operations during the visit to Atlantic Coast, only four dispatchers were interviewed. Follow-up phone interviews were conducted with two more dispatchers in order to acquire a representative sample. Interview questions, along with responses are included in appendix C.

4.5.5 Final Questionnaire.

A Final Questionnaire was developed and administered by ACT-320 personnel in order to address the overall utility, benefits, user interface issues, and enhancements. The questionnaire was developed in a web-based environment and administered via the Internet to dispatchers at both airlines. Responses were automatically placed in a dedicated file on the ACT-320 server. ACT-320 personnel oversaw completion of the on-line questionnaire at Air Wisconsin on April 20-21, 1999, and at Atlantic Coast Airlines on April 26-27, 1999. Airline personnel unavailable at those times had the option of completing the questionnaire on their own until May 5, 1999. A copy of the Final Questionnaire is in appendix D.

4.5.6 Data Analysis.

Data analysis for the User Log consisted of analyzing product ratings using the overall median score from the responses to determine the relative value of various products (both IIDA and existing operational products) in the identification of in-flight icing. Since the number of User Log forms completed by each dispatcher varied, the median of an individual's responses was used. This was done to reduce the bias from users who completed the log several times during the assessment period. The individual user response median was then used as a single data point in the overall product rating.

The median score is the most appropriate measure of central tendency when using ordinal data or when scores are not normally distributed. The median is the value above and below which

one-half of the observations fall. When there is an even number of observations, no unique center value exists, so the mean of the two middle observations is taken as the median value.

Responses to the open-ended questions on the User Log were summarized and analyzed for recurring issues, IIDA performance characteristics, and potential enhancements.

Observational information and responses to interviews were summarized to identify recurring issues, IIDA performance characteristics, and potential enhancements. In addition, clarifications on product ratings from the User Logs were summarized.

The Final Questionnaire contained several sections with rankings and ratings of IIDA components, product usefulness, user interface characteristics, and potential enhancements. In addition, an open-ended comment section was provided. Component rankings and ratings were analyzed using the median of the responses for each component in order to determine the relative usefulness. Product usefulness for specific job tasks was also analyzed using the median of the responses in order to identify the dispatch areas where IIDA provided the most value. Potential enhancements identified through the User Log and interviews were ranked using the median of the responses to determine which enhancements were most needed. The Final Questionnaire was administered once to each user, therefore, each response was used as a single data point in the analyses. Comments in the open-ended section were recorded and summarized.

5. RESULTS AND DISCUSSION.

This section presents the results of the IIDA Assessment. Section 5.1 discusses factors that may have affected the results. Section 5.2 discusses the results from the User Log. Section 5.3 discusses results from the observations and interviews. Section 5.4 discusses the results from the Final Questionnaire.

5.1 FACTORS AFFECTING RESULTS.

5.1.1 Experimental Product Implications.

IIDA is an experimental product and is clearly labeled such on its web page. As an experimental product rather than an authorized weather product, it cannot be legally used by airlines as an official product for decision-making purposes. However, its usefulness can be perceived by comparing its output to official information sources (such as Airman's Meteorological Information (AIRMET) and Significant Meteorological Information (SIGMET). Air Wisconsin tended to be very proactive with this approach by comparing IIDA output to AIRMETs, SIGMETs, METARs, and other information sources throughout the assessment period. Atlantic Coast Airlines tended to be more conservative in its approach, stressing that IIDA could not be used during operational decision-making. Therefore, assessment responses are based largely upon the perceived use of IIDA.

5.1.2 Team Leader Use.

Due to the operational configuration of flight dispatch operations at Atlantic Coast Airlines, only Team Leaders had direct access to IIDA. While the Team Leader has final decision authority on dispatch decisions, dispatchers subordinate to the Team Leader perform the actual dispatch operations, such as flight release preparation and communication with aircrews. Individual

dispatchers had limited access to IIDA. Therefore, responses from Atlantic Coast Airlines' dispatchers (other than Team Leaders) were based on hypothetical uses of IIDA.

5.1.3 Number of Responses.

While the number of Final Questionnaire responses was deemed adequate to be representative of the individual airline dispatcher population, the number of responses to the User Log was poor. This was most notable in the ranking of the IIDA components and existing operational products. Therefore, observations and interviews may be considered more representative of dispatchers' perceptions of IIDA.

5.2 USER LOG RESULTS.

The User Log was developed to provide feedback on a day-by-day basis on the performance of IIDA, job-related functions which IIDA was referenced, additional information provided by IIDA, and the value of different components and products in the identification of in-flight icing. The following sections summarize User Log feedback. Actual responses are in appendix E.

5.2.1 Performance.

Overall comments indicated that IIDA accurately portrayed icing and non-icing conditions. This impression was based upon the dispatchers' comparison of IIDA output to PIREPs, including company-only PIREPs. Most PIREPs corresponded to the higher potential areas of IIDA (i.e., icing potential >70); however, it was noted that some reports were in lower areas (i.e., icing potential <20). In addition, there were a number of occasions when no icing was reported via company PIREPs, although IIDA showed a very high potential for icing (i.e., icing potential >80).

5.2.2 Job-related Functions.

A majority of dispatchers noted that IIDA was referenced for flight release preparation (20 out of a possible 29 responses). Other areas for which IIDA was referenced were fuel and load capacity planning, route planning, and altitude planning. It was noted that, particularly for Air Wisconsin Dornier 328 aircraft dispatchers, IIDA was referenced considerably for weight restriction decisions. Instances of releasing flights for icing conditions (imposing a weight restriction) and for non-icing conditions (being able to take the maximum payload) were identified as functional areas where IIDA information could be significant in the decision-making process.

5.2.3 Additional Information Provided by IIDA.

The User Log responses indicated there were areas where IIDA provided additional information over existing operational products. Responses included the ability to view route specific graphics, including icing potential and tops. The graphics improved upon text products by providing a consolidated snapshot which was "fast, easy, and efficient." Hourly IIDA graphics were able to show the progression (both movement and growth) of icing areas with time. In addition, the graphical presentation of PIREPs, while not a specific IIDA product, was noted as being superior to text information; dispatchers were able to quickly identify what regions of the country were reporting icing conditions.

5.2.4 Value in Identifying In-flight Icing.

An attempt to rate the value of the different IIDA components and existing operational products in identifying in-flight icing was made using a 5-point Likert rating scale. Responses (see appendix E) indicated that all IIDA components with the exception of the Visible and Infrared Satellite images were of value (i.e., the component was useful in identifying in-flight icing and may enhance icing related dispatch activities). The satellite images received a neutral response (i.e., the components neither positively nor negatively affected icing related dispatch activities). Other products that yielded a neutral response included the operational icing AIRMETs and SIGMETs, METARs, and Area Forecasts. While the User Log rankings would indicate that most IIDA components were of value, information obtained during the interview and observation phase (see section 5.3.4) indicated that certain products were of more value than others.

5.2.5 Additional Comments.

Additional User Log comments indicated that IIDA provided valuable information that was used daily and was missed when it was unavailable. Log comments also suggested that PIREPs provided with IIDA were more timely than those provided by the airlines' commercial weather provider. Potential IIDA enhancements identified included a graphic loop of output fields and the inclusion of icing severity.

5.3 OBSERVATIONS AND INTERVIEW RESULTS.

The observations and interviews were conducted during the middle of the assessment. ACT-320 personnel observed and interviewed seven dispatchers at Air Wisconsin. During Atlantic Coast Airline observations and interviews, a snowstorm in the Dulles, VA, area disrupted aviation operations and limited interviews to only two dispatchers and two Team Leaders (a total of four personnel). Two additional Team Leaders were interviewed via telephone 1 week later. Structured interview questions were used to allow dispatchers to expand upon or clarify information obtained from the User Log. Interview and observation data are summarized in the following sections according to the User Log information, i.e., IIDA performance, functional areas, additional information provided by IIDA, value of products in identifying in-flight icing, and any additional comments. Complete dispatcher responses to the structured interview questions are included with the questions in appendix C.

5.3.1 IIDA Performance.

Overall, dispatchers indicated that IIDA appeared to be accurate with Icing Potential appearing to be the most accurate IIDA product. Atlantic Coast Airline participants all stated that IIDA appeared accurate. However, while Air Wisconsin participants agreed that IIDA tended to be accurate, it also tended to be "overly conservative" often identifying icing conditions when PIREPs (including company reports) and METARs indicated sky conditions were clear. Furthermore, Air Wisconsin dispatcher comments indicated that IIDA seemed to always indicate the presence of icing during the winter season. It was stated that certain locations (for example, Rapid City, South Dakota) always showed a high potential for icing aloft, even though METARs and PIREPs often did not support the existence of icing conditions. Responses also indicated that Visible Moisture and SLD Potential were not as accurate as Icing Potential. It should be noted that the accuracy responses were the subjective opinions of the participating dispatchers, rather than the results of a statistical verification exercise.

5.3.2 Functional Areas.

Dispatchers identified IIDA as being useful for flight planning. Two predominant areas of flight planning were identified: weight restrictions and inoperable equipment. If icing conditions were expected to be encountered, weight restrictions would be enacted either through extra fuel or lower payloads. Lower payloads were accomplished by reducing the number of passengers, which in turn resulted in less revenue for the airlines. Weight restrictions were especially important for Air Wisconsin Dornier 328 aircraft. If an aircraft had inoperable equipment that precluded its flight into icing conditions, IIDA was helpful in determining whether icing conditions could be expected to be encountered. In the absence of icing conditions, an aircraft with inoperable equipment could still fly.

Although not discussed in this report, a corollary benefits study conducted under AWRP sponsorship by MCR Federal Inc., identified weight restrictions as a major area where IIDA knowledge could provide a significant cost benefit (AUA-430 should be contacted for information on the benefits study).

5.3.3 Additional Information Provided by IIDA.

Dispatchers identified that IIDA provided a quick look of icing conditions that did not involve searches through lengthy information or separate plotting of information. The graphical display of IIDA made PIREPs more visible, drew immediate attention to areas that had a high potential for in-flight icing, and was automatically available. In addition, IIDA provided more detail about potential icing conditions than AIRMETs and SIGMETs, which tended to cover wide areas. IIDA was useful when PIREPs were not available (for example, early in the morning before much air traffic was available for reporting). The IIDA vertical cross sections gave point-to-point information along an aircraft's route of flight that was not available from any other sources. With only the vertical cross section, a dispatcher could see all phases of flight (i.e., departure, enroute, and arrival). The route specific information, as opposed to national information, was very important to dispatchers. In fact, all responding dispatchers from both airlines said that IIDA information (especially icing bases and tops) was accessed from the vertical cross sections.

5.3.4 Value of Products in Identifying In-flight Icing.

The IIDA component that provided the most value in identifying in-flight icing conditions was the Icing Potential viewed on a route-specific vertical cross section. The majority of dispatchers identified this as the component used the most. Very few dispatchers used a horizontal view of Icing Potential as part of the dispatch process, although a few instances of use to acquire a general picture of weather conditions was noted. Icing Bases and Tops, and in some instances Cloud Bases and Tops, were identified as providing value when viewed in a route-specific vertical cross section. While not a specific IIDA product, PIREPs were identified as being extremely important. For the observations and interviews, no other IIDA component was identified as having clearly-defined value in identifying in-flight icing (compare this finding to the User Log rating information in section 5.2.4 where most IIDA components were rated positively). Comments regarding the IIDA SLD Potential ranged from (a) not used, to (b) the same as severity, to (c) pinpointing icing. Apparently when both Icing Potential and SLD Potential existed within the same geographical area, the smaller SLD region was perceived by dispatchers as having the greatest potential for icing or increased icing severity. SLD Potential was also used to sway dispatchers' opinions in marginal icing situations.

It was noted by Air Wisconsin dispatchers that icing type was not important; this may be due to the Dornier 328's sensitivity to icing of any kind. In contrast, Atlantic Coast personnel noted that icing type is important; however, type was determined from PIREPs rather than the IIDA Icing Type component. Freezing precipitation and precipitation type components of IIDA were used by Atlantic Coast to identify freezing rain situations at airports. This use was for ground icing situations and airport closures rather than in-flight icing conditions.

5.3.5 Additional Comments.

Additional information obtained from the observations and interviews concerned display and interpretation issues, and suggested enhancements. Two displays were available to the dispatchers. The first (not shown) included a map of the Continental US along with the various IIDA components. The components could be viewed only by scrolling since all were not visible on a single web page. The second display (shown in figure 5) incorporated all the components into one web page along with a larger map of the US. Dispatchers preferred the second display shown in figure 5. Responses indicated that the larger type and map were more legible, especially when viewed from a distance. This was especially noted in areas where some computer monitors were mounted on a shelf above the dispatcher work area, rather than directly in front of the dispatchers.

There was confusion concerning the interpretation of the Icing Potential and SLD Potential red areas (i.e., those areas >70). Many assessment participants interpreted these higher potential areas as having more severe icing conditions. The misconception was partially solved through in-depth training. However, it was noted that dispatchers had to continually remind themselves that the "red" areas were not correlated with severe icing conditions. The interpretation issue appears to result from radar six-level displays where red areas are the heaviest precipitation regions.

IIDA enhancements suggested by dispatchers included the following:

a. Improved accuracy;

b. User selected routes, especially needed for deviations from standard airline routes;

c. Animation to include past output in order to identify movement and trends;

d. Automatic updates (users had to use the refresh or reload option on the Internet browser to ensure the latest images were displayed);

e. Updates more often than once per hour; it was noted that weather conditions in mountainous regions can change rapidly;

f. Enabling PIREP text to be displayed when clicking on the graphical symbol;

g. Limiting the amount of products available; and

h. Having IIDA as an approved weather information source so that it could be used for decision-making.

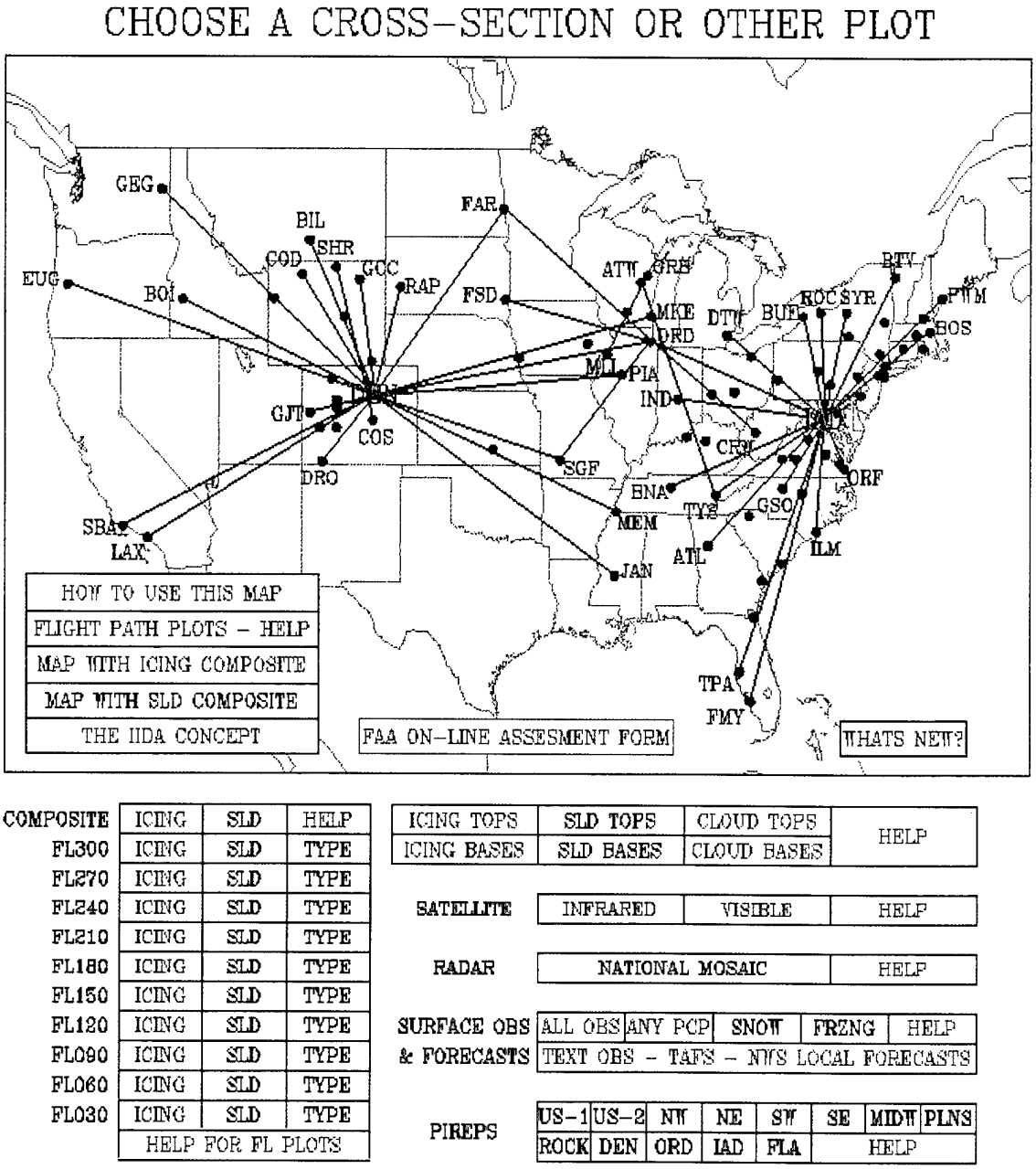

FIGURE 5. IIDA "LARGE" DISPLAY

5.4 FINAL QUESTIONNAIRE.

Results for the Final Questionnaire are summarized in the following sections. The questionnaire contained rankings and ratings of IIDA components, user interface characteristics, product usefulness and potential enhancements, along with a section for additional comments.

Seven dispatchers from Air Wisconsin responded, while 11 responses were received from Atlantic Coast Airlines (including one dispatch manager). Full responses are included in appendix F.

5.4.1 Component Ranking.

Dispatchers were asked to rank the 10 main IIDA components from the most useful to the least useful. The median calculated from all dispatcher responses was used to rank the components. Overall results for both airlines are shown in table 2; Air Wisconsin results are shown in table 3; and Atlantic Coast Airline results are shown in table 4.

TABLE 2. OVERALL RANKINGS

Rank	Component
1	Icing Potential
2	Icing Bases
2	Icing Tops
4	Cloud Tops
5	Cloud Bases
5	Visible Moisture
7	SLD Potential
8	Icing Type
8	SLD Tops
10	SLD Bases

TABLE 3. AIR WISCONSIN RANKINGS

Rank	Component
1	Icing Potential
2	Icing Bases
2	Icing Tops
4	SLD Potential
5	Cloud Tops
6	Icing Type
7	Cloud Bases
7	Visible Moisture
9	SLD Bases
9	SLD Tops

TABLE 4. ATLANTIC COAST AIRLINES RANKINGS

Rank	Component
1	Icing Potential
2	Icing Bases
2	Icing Tops
4	Cloud Tops
5	Cloud Bases
6	Visible Moisture
7	Icing Type
8	SLD Bases
9	SLD Potential
10	SLD Tops

The ranking information identified that Icing Potential was the most useful information, followed by Icing Bases and Tops. SLD Bases and Tops ranked at the bottom for both airlines; however, SLD Potential itself ranked in the upper half of the IIDA components for Air Wisconsin. This ranking may be related to the use of SLD Potential as a surrogate for icing severity or to pinpoint icing regions as noted during the dispatcher interviews (see section 5.3.4).

5.4.2 Component Ratings.

Dispatchers were asked to rate all of the components available on the IIDA display (a total of 24 components) based on usefulness in providing icing relevant information and benefit to dispatch operations. A five-point scale ranging from Highly Desirable to Highly Undesirable was used for each component. Using the median of all the responses as a measure of the desirability resulted in all 24 components being rated as desirable. However, the on-site interviews, along with observations of dispatchers in their operational settings appeared to indicate that only a limited number of IIDA components were utilized. For example, the Icing Potential viewed on a route-specific vertical cross section was used the most, with the horizontal plan view used infrequently (see section 5.3.4). Air Wisconsin responses indicated that icing type was not important, only the existence of icing. This could indicate that the IIDA Icing Type would not be a desirable product or would be Neutral at best.

5.4.3 User Interface.

Dispatchers were asked for their level of agreement with several statements concerning the IIDA user interface. Overall results indicated that the user interface was acceptable. Specifically, scale gradations were easy to differentiate; menu items were grouped meaningfully; text annotations and abbreviations were easily understood; navigation was easy; and "Help" information provided assistance. Even though the interface was identified as acceptable, some comments were noted concerning difficulty in differentiating the various shades of red and blue used in scale gradations; the tendency of some colors to blend with the background; and improvement of the PIREP symbols to make them more readable and understandable.

5.4.4 Product Usefulness for Job Tasks.

Dispatchers were asked to rate the usefulness of IIDA for several tasks. Responses indicated that IIDA had a positive effect on planning and activities related to dispatcher tasks. Relevant tasks included planning fuel quantities; planning flight routes; selecting altitude; avoidance of icing areas; monitoring flight conditions; rerouting flights; and advising pilots enroute of potential icing conditions. However, it must be noted that some responses were hypothetical, since the experimental status of IIDA did not allow it to be used for operational decision-making.

5.4.5 Potential Enhancements.

Based upon User Log and interview responses, potential IIDA enhancements were identified. Dispatchers were asked to rank the enhancements according to importance. Overall results from both airlines are shown in table 5. Duplicate numbers indicate that the enhancements in question were ranked the same.

TABLE 5. IIDA POTENTIAL ENHANCEMENT RANKINGS

Ranking	Potential Enhancement
1	Intensity
2	Animation
2	Forecast
4	Additional Overlays
5	User Selectable Routes
6	Automatic Updates
6	User Selected Zoom
8	Display of PIREP Text

Expanding upon the rankings, the requested time period for an icing forecast was 1 to 6 hours. Additional overlays requested included Very High Frequency (VHF) OmniRange Navigation System (VOR), arrival and departure gates, additional aviation fixes, additional cities, and Aircraft Situation Display (ASD) information.

6. CONCLUSIONS.

6.1 ASSESSMENT OBJECTIVES.

Section 4.4 identified the objectives for the Integrated Icing Diagnostic Algorithm (IIDA) Assessment. Individual objectives are restated in the following sections along with conclusions addressing each specific objective.

Objective: Determine the utility of IIDA to regional airline dispatchers:

Overall, IIDA was useful to airline dispatch operations. Specifically, IIDA was used for flight planning and flight release preparation, especially fuel and load planning. IIDA was also useful for identifying potential icing conditions when Pilot Reports (PIREP) were not available.

The IIDA Icing Potential product viewed in a vertical cross section provided the most value. Icing Bases and Tops were also beneficial when viewed in the vertical cross section. The vertical cross section gave point-to-point information, covering all phases of flight in one quick look. Icing Type was not important for Air Wisconsin operations, whereas it was considered important by Atlantic Coast Airlines but not as beneficial as Icing Potential, Bases and Tops. The Supercooled Large Drop (SLD) Potential, Bases and Tops raised issues due to its use. When SLD products were used, they were used as an indicator of icing intensity or as the deciding factor in marginal Icing Potential situations. Even though National Center for Atmospheric Research (NCAR) provided extensive training on SLD, there still appears to be confusion concerning the information that SLD Potential conveys.

Dispatchers perceived IIDA products to be accurate for the detection and absence of icing conditions with the Icing Potential viewed as the most accurate component. However, Air Wisconsin dispatchers noted that IIDA had a tendency to over forecast, often showing icing when observations (i.e., PIREPs and Aviation Routine Weather Report (METAR)) indicated clear sky conditions. It is not known whether this tendency is a regional issue dealing with conditions in the Midwest and Rocky Mountain region where most of Air Wisconsin's flights occur. The over forecasting was not identified by Atlantic Coast Airlines.

Of note is the low ratings received by the official aviation icing forecasts: Airman's Meteorological Information (AIRMET) and Significant Meteorological Information (SIGMET). While AIRMETs advise of weather that may be hazardous to single engine, other light aircraft, and Visual Flight Rule (VFR) pilots, and thus may not be applicable to regional airlines; SIGMETs advise of weather potentially hazardous to all aircraft. However, the feedback from the User Log indicated that dispatchers believe that AIRMETs and SIGMETs neither positively nor negatively affect icing related dispatch activities.

Objective: Assess human computer interface issues, such as meaningful color coding, navigation, access to products, and adequate overlays.

Overall, the IIDA human computer interface was found by the assessment dispatchers to be acceptable. The IIDA display did not require the searching and plotting of information that dispatchers currently have to perform. The graphical display brought immediate attention to potential icing areas.

Dispatchers identified that a large display was preferred. Many dispatch operations areas do not allow the placing of a computer monitor immediately in front of a dispatcher. Thus, dispatchers have to be able to read displays that may be above the work area, between adjacent work areas or other configurations that preclude up-close viewing. Therefore, graphics and text need to be large and readable at a distance.

Dispatchers did identify some difficulties associated with the colors used in the IIDA display. There was some difficulty in differentiating some of the various shades of blue and red on the IIDA color scales. In addition, although IIDA presented no information on the intensity of icing, dispatchers were prone to interpret red areas (i.e., high potential) as intense icing. This tendency was overcome in the assessment by the training sessions given to the dispatchers. However, it is not possible to train every potential user of IIDA if it were to become an operational product. Therefore, the interpretation of red areas as a measure of intensity needs to be addressed.

Objective: Identify potential benefit areas, including how IIDA information alters previous ways of accomplishing a task and the implications.

Dispatchers used IIDA in the following areas: flight planning; payload decisions; monitoring of flight conditions; and the use of aircraft with inoperable equipment. A significant benefit area appeared to be with payload decisions. This was especially true for the Air Wisconsin Dornier 328 aircrafts. These aircrafts are very sensitive to flight into icing conditions. If icing conditions are expected, then the payload (i.e., the number of passengers) has to be decreased. With the route specific icing information available from IIDA, dispatchers were able to make better decisions on whether payload restrictions due to icing would have to be implemented.

Another significant benefit area is with aircraft with inoperable equipment. Depending upon the type of inoperable equipment, an aircraft may still operate as long as icing conditions are not encountered. Thus, IIDA information could help with the decision to keep an aircraft flying and avoid potentially unnecessary cancellations.

In addition to the benefit areas identified above, dispatchers indicated that they believed IIDA had a safety benefit, increasing their knowledge of potentially hazardous situations.

While one of the objectives of the IIDA Assessment was to identify potential benefit areas, MCR Federal Inc. is performing a quantification of any potential benefits. Their report will be available from the Aviation Weather Research Program (AWRP) program office, AUA-430.

Objective: Identify potential enhancements to IIDA.

Dispatchers identified various potential enhancements to IIDA. The enhancements rated the highest were icing intensity, animation, and a 1- to 6-hour forecast. The addition of icing intensity would include the designation of light, moderate, and severe icing conditions. Intensity was identified as a desired IIDA enhancement in a 1998 assessment conducted by ACT-320 at the Aviation Weather Center (see sections 1.1 and 2). Animation was identified as a desired enhancement in order to allow dispatchers to see past movement and trends in icing regions. Dispatchers also identified an icing forecast as a desired enhancement to give information about expected conditions. Flight releases are normally prepared and issued 1 to 2 hours prior to departure. If a flight is scheduled for 1 hour, then the IIDA information used to develop the flight release could be up to 3 hours old by the time the aircraft is in its last stages of flight.

Thus, a forecast component to IIDA would be potentially useful. Since most continental United States flights flown by the regional airlines are on the order of 1 to 2 hours, a 1- to 6-hour forecast would be adequate taking into account the release of the flight plan prior to the actual departure.

Other enhancements that were identified included additional overlays to allow dispatchers to more accurately determine locations of icing conditions; user selected routes to take into account deviations from standard routes; automatic updates in order to alleviate the need to use the Internet browser refresh button; a user selected zoom to allow users to examine regions of interest in more detail; the availability of PIREP text information by clicking on the graphical representation; and the inclusion of IIDA into an Aircraft Situation Display (ASD) to allow tracking of aircraft on the same display as important weather information. It should be noted that the Aviation Digital Data Service (ADDS) has the capability for user-selected routes and the availability of PIREP text by clicking on the graphical representation. The need for these two enhancements should be weighed against what is currently available on the ADDS site. It should also be noted that IIDA is available as an experimental product on ADDS.

Finally, it was noted that it was desired that IIDA become an approved source of weather information. Dispatchers recognized the value of IIDA; however, due to the experimental status of the product, they were legally constrained from using the product for operational decisions.

Objective: Analyze icing verification information obtained from regional airline flight crews via comparisons to IIDA output.

Due to dispatcher resources required to provide feedback on IIDA, this objective was not addressed in the assessment.

6.2 USE OF SLD INFORMATION.

It was identified during the assessment that SLD information was used as a proxy for intensity (i.e., if SLD Potential existed, then the area was interpreted as an area of severe icing); was used as a confirmation of the occurrence of icing; or the information was not used. While SLD has been an area of high priority within the Federal Aviation Administration (FAA) AWRP, it appears that confusion concerning the use of SLD information exists.

7. RECOMMENDATIONS.

a. The 1998-1999 Integrated Icing Diagnostic Algorithm (IIDA) Assessment demonstrated the utility of IIDA to regional airline dispatch operations. Therefore, IIDA should be considered for adoption as an official aviation weather product that could be legally used by all airlines. However, certain issues should be addressed prior to official use. These issues are:

1. Based upon assessment results demonstrating an almost exclusive use of the Icing Potential in a vertical cross section (e.g., see sections 5.3.3 and 5.3.4), an operational in-flight icing detection product should consist of the IIDA Icing Potential, Bases and Tops, coupled with Pilot Report (PIREP), viewable in a route-specific vertical cross section. The number of current IIDA components should be limited.

2. National Center for Atmospheric Research/Research Applications Program (NCAR/RAP) should investigate IIDA's perceived tendency to over forecast. The extent of any over forecasting should be determined, including any regional tendencies.

3. The training of Internet users needs to be addressed to ensure that high potentials (i.e., red areas) are not interpreted as being correlated with icing intensity.

4. The use and understanding of Supercooled Large Drop (SLD) information needs to be addressed. If it becomes apparent that SLD information is confusing or is interpreted incorrectly within the aviation community, consideration should be given to not displaying separate SLD products. SLD information could still be incorporated into icing products.

b. Building upon the utility identified in the current IIDA configuration, further development should focus on three areas:

1. Possible animation of an Internet-based product.
2. Inclusion of icing intensity (i.e., low, moderate, and severe)
3. A 1- to 6-hour forecast capability.

c. Additional research should be conducted to determine whether the icing-related usefulness ratings of Airman's Meteorological Information (AIRMET) and Significant Meteorological Information (SIGMET) are neutral or low at other airlines. If the ratings are found to be similar, the Aviation Weather Center (AWC) should give consideration to modification or replacement of these products with a gridded icing product that could give detailed information in both the vertical and horizontal dimensions.

8. ACRONYMS.

146	Bombardier 146 aircraft
328	Dornier 328 aircraft
ACT-320	FAA Technical Center Weather Branch
ADDS	Aviation Digital Data Service
AIRMET	Airman's Meteorological Information
ASD	Aircraft Situation Display
AWC	Aviation Weather Center
AWRP	Aviation Weather Research Program
CRJ	Canadair Regional Jet
FAA	Federal Aviation Administration
GOES	Geostationary Orbiting Environmental Satellite
IIDA	Integrated Icing Diagnostic Algorithm
J32	Jetstream 32 aircraft
J41	Jetstream 41 aircraft
km	kilometer
METAR	Aviation Routine Weather Report
NCAR/RAP	National Center for Atmospheric Research/Research Applications Program
NCEP	National Centers for Environmental Prediction
NEXRAD	Next Generation Weather Radar
NIDS	NEXRAD Information Dissemination Service
NWS	National Weather Service
PIREP	Pilot Report
RUC	Rapid Update Cycle

SIGMET	Significant Meteorological Information
SLD	Supercooled Large Drop
VFR	Visual Flight Rule
VOR	Very High Frequency (VHF) OmniRange Navigation System
2-D	Two-dimensional
3-D	Three-dimensional

APPENDIX A

BASELINE INFORMATION

Integrated Icing Diagnostic Algorithm (IIDA) Baseline Data Collection

Background: ACT-320 personnel conducted IIDA baseline data collection at Atlantic Coast and Air Wisconsin Airlines on September 23 and 24, 1998, respectively. This document provides a summary of techniques at both airlines used for detecting and forecasting aircraft icing. Structured interview questions used at both airlines are attached, along with responses.

Discussion: Information obtained from the responses to interview questions are summarized in the following paragraphs.

1. Atlantic Coast Airlines:

Three types of aircraft are used by Atlantic Coast Airlines: Jetstream 32 (J32), Jetstream 41 (J41), and Canadair Regional Jets (CRJ). The J32 and J41 are turboprop aircraft, while the CRJ is a jet aircraft. Dispatch responsibilities are divided by aircraft type into teams of two dispatchers and one team leader.

A total of ten dispatchers were interviewed. Of those interviewed, four were responsible for the J32s; four were responsible for the J41s, and two were responsible for the CRJs.

In-flight icing is primarily an enroute hazard for the J32s and J41s. The CRJs are equipped with anti-icing systems which tend to minimize the in-flight icing hazard. The J32 and J41 are equipped with de-icing systems which must be activated by the flight crew.

a. J32: These aircraft have about a 400 mile range and are usually enroute about one hour, with a maximum altitude of 25,000 feet. Areas of coverage include Washington to New York and similar length routes. Icing results in aircraft performance degradation, reroutes, and delays. The operations specification (ops spec) for the J32 states that aircraft will not be dispatched into moderate or greater icing conditions. Forecasts of light icing do not have an impact upon flight operations. Aircraft have de-icing boots on the leading edge of the wings.

b. J41: These aircraft operate on longer flights than the J32s. Flight coverage is along the East Coast from Maine to North Carolina and west to Ohio. Flights last from one to two hours. Flight altitudes are up to 25,000 feet. The J41s have de-icing systems which must be activated by the flight crew upon identification of ice buildup on the aircraft. In-flight icing causes performance degradation, reroutes, and delays.

c. CRJ: These aircraft are generally used for the longest flights, e.g., Maine to Florida and Washington to Chicago. The longest flights are on the order of two hours. Flight levels are usually between 24,000 and 35,000 feet, with a maximum altitude of 41,000 feet. In-flight icing is not a significant problem due to the aircraft's normal operating altitude and the presence of anti-icing systems on the aircraft. Ground de-icing is more of a problem.

d. Icing Information:

Dispatchers use the following techniques for identifying icing conditions:

(1) METARs: used for identifying surface observations of freezing precipitation; cloud bases; and ground icing condition if temperature is $\leq 10^{\circ}C$ and clouds exist.
(2) TAFs: used to identify cloud bases along route.
(3) PIREPs: identified as the most reliable source of information.
(4) Area Forecasts (FAs): used to identify presence of clouds.
(5) Low level significant weather prognostic charts: gives forecasted areas of icing.
(6) SIGMETs: text format only, must be manually drawn or mentally integrated into route of flight; manually combined with radar data to identify where clouds (i.e., moisture) exists.
(7) Winds and temperatures aloft: used to identify sub-freezing temperatures, however, are available only for specific points along the route of flight; used in conjunction with clouds aloft from TAFs along route (if temperature $\leq 10^{\circ}C$, then presence of clouds infers icing).
(8) Radar: used to identify regions of precipitation and thus clouds.
(9) Internet ASD Freezing Level product (www.diversifiedgroup.com/prod4.htm).
(10) Dispatchers are aware of AIRMETs, but do not tend to use them. AIRMETs are relegated to general aviation use, not commercial carriers. In addition, AIRMETs tend to cover large geographical areas and during the winter "almost always exist in New England" making them of little practical value.

Icing information is contained in the "Weather Data" section of the flight release which is generally issued one hour before flight departure. The weather data includes METARs and TAFs from the departure airport, airports along the route of flight, and the destination airport. Winds and temperatures are included at flight levels of 3000, 6000, 9000, 12000, 18000, 24000, 30000, 34000, and 39000 feet. Freezing level information is often interpolated from the temperatures aloft data. SIGMETs are also provided. All information is in a text format. Hard copies of the flight release can be made available, along with text display on a dispatcher monitor.

e. Desired Products:

Dispatchers would like to see products that depict levels (or at least the tops and bases) where icing exists; intensities; and types (rime, mixed, or clear). While text information of icing levels would be useful, a graphic would be best. The graphic should include overlays such as VORs, ARTCC boundaries, airports, and airways. A three-dimensional top down look, along with vertical profiles is desired.

An icing forecast product would be useful. The forecast should extend out to at least six hours.

2. Air Wisconsin:

Two types of aircraft are used by Air Wisconsin: Dornier 328 and 146. The 328s are turboprop aircraft, while the 146s are jet aircraft. Dispatch responsibilities are divided by aircraft type with one dispatcher per each type and an overall dispatch coordinator.

A total of six dispatchers were interviewed. Of those interviewed, two were responsible for the 328s; two were responsible for the 146s, and two were dispatch coordinators.

a. **328s:** Icing is the winter "nemesis" for the 328s. Even trace icing produces a performance degradation resulting in less passengers, extra fuel for rerouting, and safety concerns. The 328s operate exclusively in the Rocky Mountain region (CO, WY, and SD) with the longest flights lasting about one hour. Normal operating flight levels are 20,000 to 30,000 feet.

b. **146s:** The 146s, as jet aircraft flying faster and at higher altitudes than the 328s, are not as susceptible to in-flight icing hazards. However, on occasion when the 146s fly at lower altitudes or at slower speeds, icing can be a factor. The 146s are equipped with anti-icing systems. Flights cover the western 2/3 of the US. The longest flight times are 2.5 hours.

c. **Icing Information:**

Dispatchers use the following techniques for identifying icing conditions:

(1) METARs: used for identifying ground observations of freezing precipitation; and ground icing conditions if temperature is $\leq 5^{\circ}C$ and clouds exist; small temperature – dewpoint spreads are used to identify moist (i.e., high humidity) areas likely to have clouds.
(2) TAFs: used to identify cloud bases along route.
(3) PIREPs: mainly from 328 flight crews; 146 crews tend to not report icing conditions due to use of anti-icing systems on aircraft which result in little impact upon operations.
(4) AIRMETs and SIGMETs: must be manually drawn or mentally integrated into route of flight.
(5) Winds and temperatures aloft: used to identify sub-freezing temperatures at specific points along the route of flight; used in conjunction with clouds aloft from TAFs (if temperature is $\leq 5^{\circ}C$, then presence of clouds infers icing).
(6) Radar: used to identify regions of precipitation, inferring clouds.

Icing information is provided in the weather briefing portion of flight releases issued to flight crews about two hours before departure. The weather briefing contains METARs and TAFs from departure, destination, and route of flight locations; PIREPs from the route of flight; winds and temperatures aloft; text radar reports; and text AIRMETs and SIGMETs.

d. **Desired Products:**

Icing information should include levels of icing, tops, freezing level, intensity, type, and areal coverage displayed in a graphical, color-contoured manner.

An icing forecast product would be useful. For operational purposes, the forecast should go out two to four hours; for overnight maintenance of aircraft an eight hour forecast is desired in order to determine the likelihood of returning aircraft to operations (note that all maintenance is performed at Appleton, thus aircraft have to fly to Appleton

from their home base and return for the next day's operations); for dispatcher awareness of what to expect in the coming day a twenty-four hour forecast was desired.

Conclusions:

1. For both Atlantic Coast and Air Wisconsin, the turboprop aircraft are impacted more by in-flight icing than the jet aircraft. Impacts included performance degradation, reroutes, delays, and safety concerns.

2. Current techniques for detecting in-flight icing rely heavily on inferences from ground observations, radar, and temperatures aloft. PIREPs are the most reliable method that dispatchers from both airlines use. There are no automated icing detection or forecasting algorithms in use at either airline.

3. Dispatchers from both airlines desire icing products that graphically depict levels of icing (including tops and bases), icing intensity, and type in both horizontal and vertical cross section views. Color coding should be used to delineate areas of icing. Forecasts would also be desirable with a forecast period of about six hours for dispatch operations and longer for planning purposes.

Structured IIDA Baseline Questions for Regional Airlines

Position_____ Aircraft type_____ Haul_____ Shift_____

1. During the winter months (also late fall, early spring), what kind of weather poses the greatest impact to you operationally?

2. What kinds of icing conditions pose the greatest operational problems?

3. What are the greatest dangers/problems associated with icing?

4. How do icing conditions effect dispatch operations?

   - What do you do?

5. When icing conditions exist, how do you disseminate the information to the flight crew?

6. What kinds of icing conditions do you tend to avoid (e.g., icing below 20,000 ft)?

7. How do you currently detect and forecast icing areas? What sources of information do you use?

8. What kinds of information relative to icing would be useful to you? E.g., intensity, icing tops, freezing precip, icing type, precip type?

9. How and where would you like to see this information presented?

   - graphically
   - textually
   - overlays (i.e. geographic, flight routes)
   - existing weather displays

10. Given an icing forecast component, what would be the ideal forecast time?

    - 1 hour? 2 hours?

11. Would information about SLD be useful to you?

    - How do you forecast/detect SLD now?

Structured interview questions are followed by responses.

1. During the winter months, what kind of weather poses the greatest impact to you operationally?

Atlantic Coast Airlines – J41 and J32 Dispatchers

Overall:

1. Icing.

Other:

2. Snow.
3. Ground icing .
4. Frozen precipitation.

Atlantic Coast Airlines – Regional Jet Dispatchers

1. Icing.
2. Snowstorms.

Air Wisconsin Dornier 328 Dispatchers

Overall:

1. Icing (enroute and ground).

Other:

2. Snow.

Air Wisconsin 146 Jet Dispatchers

1. Icing (enroute).
2. Snow.
3. Ground icing and deicing.

Air Wisconsin Dispatch Coordinators

1. Icing.
2. Snow.
3. Ground icing.
4. Mountain obscurations.

2. What kinds of icing conditions pose the greatest operational problems?

Atlantic Coast Airlines – J41 and J32 Dispatchers

1. Clear ice.
2. Rime ice.
3. All icing types.
4. Freezing rain (on ground).

Atlantic Coast Airlines – Regional Jet Dispatchers

1. Clear ice.
2. Ground icing.

Air Wisconsin Dornier 328 Dispatchers

1. All icing - can contribute to performance degradation. Based on the performance manual, even trace ice can incur aircraft performance degradation.
2. Clear ice.
3. Freezing rain.

Air Wisconsin 146 Jet Dispatchers

1. Icing is not a significant problem for the 146 jets since they have anti-icing equipment.
2. May be restricted performance under 26,000 ft. where fly at slower speeds.

Air Wisconsin Dispatch Coordinators

1. Icing is not a major problem for the 146 jets due to anti-icing devices, however for the Dornier 328s, icing is a problem.
2. Icing takes toll on aircraft performance.
3. Load factors drop dramatically.
4. Payloads must be cut to accommodate more fuel.

3. What are the greatest dangers/problems associated with icing?

Atlantic Coast Airlines – J41 and J32 Dispatchers

1. Aircraft performance.
2. Effect on flight controls.
3. Loss of lift.

Atlantic Coast Airlines – Regional Jet Dispatchers

Although jets have anti-icing equipment, the crew could be inexperienced and not know how to address icing problems.

Air Wisconsin Dornier 328 Dispatchers

1. Aircraft performance.
2. Additional weight and drag.

Air Wisconsin 146 Jet Dispatchers

N/A

Air Wisconsin Dispatch Coordinators

N/A

4. How do icing conditions effect dispatch operations? What do you do?

Atlantic Coast Airlines – J41 and J32 Dispatchers

Overall

1. Avoidance/reroute.

Other

2. Delays.
3. Flight cancellation.
4. Change altitude.
5. Increased workload.
6. On time performance degradation.

Atlantic Coast Airlines – Regional Jet Dispatchers

1. Avoidance/reroute.
2. Change altitude.
3. Light icing is not a factor. With moderate to severe icing, need to know icing altitude.

Air Wisconsin Dornier 328 Dispatchers

1. Reroute.
2. Less passengers – loss of revenue.

Air Wisconsin 146 Jet Dispatchers

1. Reroute/avoid.
2. Change altitude.
3. Cancel or delay flight.
4. If discrepancy on aircraft or anti-icing device malfunctioned, then aircraft would have to fly to avoid icing conditions.

Air Wisconsin Dispatch Coordinators

1. Fuel planning.
2. Passenger utilization.
3. Safety.
4. Change altitude.
5. Effects number of available aircraft. If aircraft cannot get back to Appleton or is delayed, then maintenance cannot be performed as scheduled. Therefore, aircraft cannot be flown which cuts down on the number of flights and passengers.

5. When icing conditions exist, how do you disseminate the information to the flightcrew?

Atlantic Coast Airlines

1. Via ACARS – advises flightcrew of freezing level and winds aloft.
2. Before take-off, can brief icing conditions via telephone.

Air Wisconsin

1. Will advise in the weather briefing.
2. Telephone before take-off if conditions are unusual.

6. What kinds of icing conditions do you tend to avoid (e.g., below 20,000 ft)?

Atlantic Coast Airlines – J41 and J32 Dispatchers

1. 4 – 6,000 ft. aloft.
2. up to 24,000 ft.
3. Below 18,000 ft.

Atlantic Coast Airlines – Regional Jet Dispatchers

1. 29,000 – 33,000 ft. for longer flights.
2. 24,000 – 26,000 ft. for shorter flights.
3. 12,000 ft and above.
4. No higher than 40,000 ft.

Air Wisconsin Dornier 328 Dispatchers

1. 20,000 – 28,000 ft.
2. 23,000 – 25,000 ft.
3. 15,000 feet and above.

Air Wisconsin 146 Jet Dispatchers

26,000 ft. and above.

Air Wisconsin Dispatch Coordinators

10,000 – 29,000 ft.

7. How do you currently detect and forecast icing areas? What sources of information do you use?

Atlantic Coast Airlines – J41 and J32 Dispatchers

1. PIREPS
2. Icing SIGMETs
3. Icing AIRMETs
4. Convective SIGMETs
5. TAFs
6. Kavouras radar composite
7. METARs
8. Cloud cover
9. Freezing rain
10. Temperatures aloft

Atlantic Coast Airlines – Regional Jet Dispatchers

1. ASD Internet display with freezing levels.
2. NWS Area Forecasts.
3. PIREPs.
4. Freezing levels.
5. Temperatures aloft.
6. TAFs.
7. SIGMETs.

Air Wisconsin Dornier 328 Dispatchers

1. AIRMETs.
2. SIGMETs.
3. PIREPs.
4. Temperatures aloft.
5. Temperature below 5 degrees C and presence of clouds or precipitation.
6. Existence of clouds over mountainous areas.

Air Wisconsin 146 Jet Dispatchers

1. AIRMETs.
2. SIGMETs.
3. Kavouras radar
4. Temperatures aloft.
5. Convective SIGMETs.

Air Wisconsin Dispatch Coordinators

1. PIREPs.
2. AIRMETs.
3. Convective SIGMETs.

8. What kinds of information relative to icing would be useful to you? E.g., intensity, icing tops, freezing precip, icing type, precip type?

Atlantic Coast Airlines – J41 and J32 Dispatchers

1. Icing type.
2. Identification of icing areas.
3. Icing severity.
4. Levels.
5. Trends.
6. Tops.
7. Temperature.
8. PIREPs.
9. Timely updates.

Atlantic Coast Airlines – Regional Jet Dispatchers

1. Icing type.
2. PIREPs.
3. Icing intensity.
4. Airway/jetway overlays.
5. Freezing levels.
6. Temperature.

Air Wisconsin Dornier 328 Dispatchers

1. Icing intensity.
2. Icing levels.
3. Accuracy.
4. Tops.
5. Icing identification along specific routes.

Air Wisconsin 146 Jet Dispatchers

1. Icing levels.
2. Temperature.
3. Icing trends.
4. Icing location.
5. Icing forecast.

Air Wisconsin Dispatch Coordinators

1. Icing location and scope.
2. PIREPs.
3. Intensity.
4. Routes of flight overlaid.
5. SIGMET plots.

9. How and where would you like to see this information presented? Graphically, textually, overlays, existing weather displays?

Atlantic Coast Airlines – J41 and J32 Dispatchers

1. Composite map – similar to radar summary.
2. Trending.
3. Color graphics similar to Kavouras.

Atlantic Coast Airlines – Regional Jet Dispatchers

1. Displayed on a map.
2. Color.
3. VORs, fixes and routes overlaid.

Air Wisconsin 146 Jet Dispatchers

1. Map display.
2. Color coding to indicate icing conditions.
3. Animation for trending.

Air Wisconsin Dispatch Coordinators

1. Geographic locations.
2. Color graphics.

10. Given an icing forecast component, what would be the ideal forecast time?

Atlantic Coast Airlines – J41 and J32 Dispatchers

1. 4–6 hours.
2. 1-6 hours.
3. 4-5 hours.
4. 2-3 hours.

Atlantic Coast Airlines – Regional Jet Dispatchers

1. 1-3 hours.
2. 4-5 hours.

Air Wisconsin Dornier 328 Dispatchers

2 hours.

Air Wisconsin 146 Jet Dispatchers

2-3 hours.

Air Wisconsin Dispatch Coordinators

1. 2-4 hours.
2. 8 hours (for maintenance planning)

11. Would information about SLD be useful to you? How do you forecast/detect SLD now?

Atlantic Coast Airlines – J41 and J32 Dispatchers

Overall, not used. May be helpful information.

Atlantic Coast Airlines – Regional Jet Dispatchers

Overall not used.

Air Wisconsin Dornier 328 Dispatchers

Overall not used, but information might be helpful.

Air Wisconsin 146 Jet Dispatchers

Overall not used, but information may be helpful.

Air Wisconsin Dispatch Coordinators

Overall not used, but information may be helpful.

APPENDIX B

USER LOG

IIDA Assessment User Log

This form has been prepared for Atlantic Coast Airlines and Air Wisconsin dispatchers in order to obtain daily feedback on the Integrated Icing Diagnostic Algorithm (IIDA). If possible, please respond to all questions as honestly and thoroughly as you can. This form should be completed once each shift during the assessment period.

Responses to this form will remain ANONYMOUS and CONFIDENTIAL. A report will be written on the results of this form, summarizing respondents' comments; however, no one will be identified or associated with any specific comment.

1. Please enter your first and last name (this information will be kept confidential):

Name _____

2. Dispatch Position (Choose the appropriate box for your current shift):

- ❍ 146
- ❍ 328
- ❍ J32
- ❍ J41
- ❍ CRJ
- ❍ Coordinator
- ❍ Supervisor
- ❍ Other (please identify) _____

3. Please comment on today's performance of IIDA in identifying in-flight icing; including geographical location, altitude, icing reports, intensity, type, and specific IIDA products referenced:

4. For what job-related functions was IIDA referenced (check all that apply):

- ❒ Flight release preparation
- ❒ Fuel and or load capacity planning
- ❒ Routing planning
- ❒ Other (please identify in comments below):

Please comment how IIDA affected any of the above functions:

5. Did IIDA add anything to your knowledge of today's icing situation that could not be readily perceived from other information sources, such as PIREPs or AIRMETs?

❍ Yes ❍ No

Comments:

6. Rate the following products according to their value in identifying in-flight icing:

Rating Definitions (see attached)

	Not Used	No Value	Little Value	Neutral	Value	High Value
IIDA Products:						
Icing Potential	❍	❍	❍	❍	❍	❍
SLD Potential	❍	❍	❍	❍	❍	❍
Icing Type	❍	❍	❍	❍	❍	❍
Icing Bases	❍	❍	❍	❍	❍	❍
Icing Tops	❍	❍	❍	❍	❍	❍
SLD Bases	❍	❍	❍	❍	❍	❍
SLD Tops	❍	❍	❍	❍	❍	❍
Cloud Bases	❍	❍	❍	❍	❍	❍
Cloud Tops	❍	❍	❍	❍	❍	❍
Visible Moisture	❍	❍	❍	❍	❍	❍
IIDA Precip. Products						
Any	❍	❍	❍	❍	❍	❍
Freezing	❍	❍	❍	❍	❍	❍
All Snow	❍	❍	❍	❍	❍	❍

	Not Used	No Value	Little Value	Neutral	Value	High Value
IIDA Satellite Products						
Visible	❍	❍	❍	❍	❍	❍
Infrared	❍	❍	❍	❍	❍	❍
IIDA Graphical PIREPs	❍	❍	❍	❍	❍	❍
AIRMETs	❍	❍	❍	❍	❍	❍
SIGMETs	❍	❍	❍	❍	❍	❍
TAFs	❍	❍	❍	❍	❍	❍
METARs	❍	❍	❍	❍	❍	❍
Temperatures Aloft	❍	❍	❍	❍	❍	❍
Radar	❍	❍	❍	❍	❍	❍
Area Forecasts (FAs)	❍	❍	❍	❍	❍	❍
Voice PIREPs	❍	❍	❍	❍	❍	❍
Textual PIREPs	❍	❍	❍	❍	❍	❍
Other [ ]	❍	❍	❍	❍	❍	❍
Other [ ]	❍	❍	❍	❍	❍	❍

7. Please provide any additional comments:

[ ]

Thank you for your responses! If you have any questions about this form please contact either Danny_Sims@admin.tc.faa.gov or Cynthia_B_Fidalgo@raytheon.com.

Submit Form | Reset Form

Return to IIDA Product

Definitions of IIDA User Log Ratings

No Value – This response indicates the icing product/information source provides **no usefulness** overall in identifying in-flight icing and **consistently impedes** icing related dispatch activities.

Little Value – This response indicates the icing product/information source provides **little usefulness** overall in identifying in-flight icing and **may impede** icing related dispatch activities.

Neutral – This response indicates the icing product/information source **neither positively nor negatively** affects icing related dispatch activities.

Value – This response indicates the icing product/information source is **useful** overall in identifying in-flight icing and **may enhance** icing related dispatch activities.

High Value – This response indicates the icing product /information source is **very useful** overall in identifying in-flight icing and **consistently enhances** icing related dispatch activities.

APPENDIX C

INTERVIEW QUESTIONS AND RESPONSES

Interview Questions and Responses for Air Wisconsin

1. IIDA was identified as being "valuable for flights." Do you agree? If so, how was it valuable?

   - *Is valuable when know icing exists; value in cross-sections where can break flight into segments (departure, enroute, and arrival); less valuable when if IIDA shows icing and other information (PIREPs, METARs, radar) show clear.*
   - *Used a lot for 328s (turboprops); medium use for 146s (jet); used with other sources as another tool.*
   - *Valuable in mountainous areas; used for pre-flight planning and as basis for of icing forecast.*
   - *Is valuable as one of many sources for planning; one of the better sources along with PIREPs, AIRMETs, and radar.*
   - *More valuable for 328s than 146s since 328s are more restrictive; an added piece of information; national picture gives an idea of what is occurring.*
   - *IDA is part of the picture; used in conjunction with other sources; helps in deciding whether to flying icing or non-ice, weight, and routing; equal in value to other sources; most useful for 328s.*

2. What factors affect maximum take-off weight? How does IIDA information affect maximum take-off weights?

   - *If icing, may have to drop 5-6 passengers; if weather is poor need to add fuel for alternate; used IIDA vertical cross section with other information needed for maximum take-off weight decisions from METARs and flight crew feedback.*
   - *There is a weight benefit, 1000 pounds = 4 people which means more revenue; IIDA is 2nd or 3rd piece of information after METARs and radar; reaffirms other information.*
   - *Used for drift down decisions.*
   - *Used for drift down decisions; icing affects payload, bumping passengers; IIDA helps in mornings before PIREPs are available.*

3. Does IIDA information increase the safety level? If so, how?

   - *It could, especially if it were more accurate.*
   - *Probably to some extent.*
   - *Perhaps.*
   - *Yes, increases vigilance; areas of high potential (i.e., red) draws attention and then look at PIREPs and AIRMETs, routes, and zoomed in PIREPs.*
   - *Yes.*
   - *Yes by increasing overall awareness; it is easy to miss PIREPs but IIDA displays on area maps making them more visible.*
   - *Yes by allowing to see where icing is and where can route around it; better than a SIGMET which is too general and doesn't give enough detail.*

4. Did you use IIDA information for flight planning? If so, how was IIDA information used?

   - *If IIDA shows bad weather then flights are released "icing", if no feedback will continue, feedback only happens when have discrepancies; also used IIDA PIREPs and icing tops.*
   - *Somewhat used; can't get route information (cross-sections) on diversions.*
   - *Yes.*
   - *Vertical cross section icing potential and tops used for climb-out, descent, and routing.*
   - *Vertical cross sections used; icing affects payload, bumping passengers, and drift down.*

5. How do you perceive the accuracy of IIDA?

   a. Which products (e.g., potential, icing type, etc...) are perceived as accurate?
   b. What is the accuracy measured against?

   - *Based upon PIREPs and company reports, sometimes shows the opposite of what's occurring, goes both ways.*
   - *IIDA is always detecting icing even when nothing is there; Visible Moisture also over-detects along with SLD Potential; Icing Potential seems most accurate, is very accurate when icing exists; visible moisture seems inaccurate compared to METARs.*
   - *METARs, PIREPs, and company reports say clear but IIDA shows icing; tends to identify when icing does exist; IIDA is trusted more the higher the potential; Updates were not timely.*
   - *Seems pretty accurate but have clear days with IIDA showing high potential, accuracy compared to company PIREPs; visible moisture never seemed to change, was always showing blue area, always looked the same, always something there.*
   - *IIDA is overly conservative; Visible Moisture always shows all altitudes, even when there is no moisture, it is the least accurate product.*
   - *Not ready to make a judgement; used IIDA as general information rather than specific information.*
   - *METARs say clear and IIDA says icing; have not seen reverse situation; Rapid City always shows "red" (i.e., high potential).*

6. Did you use the Icing Potential product? If so, did you use Icing Potential more than other icing products? If so, why? (Note: Icing Potential was used more than any other product according to the User Log.)

   - *Vertical cross section used the most for Icing Potential; if potential is 10% or less will send aircraft non-icing, if over 50% will send "icing."*
   - *Icing potential on vertical cross section used the most; others not accurate.*
   - *Icing potential on vertical cross section used the most; is quick; explicit; gives point-to-point information.*
   - *Icing Potential used the most.*
   - *Icing potential on vertical cross section used the most; also used METARs and TAFs from ADDS; all give weight to decisions made.*
   - *Icing Potential on national scale used first, then zoom into region for PIREPs.*
   - *Icing Potential on vertical cross section, then icing and cloud bases and tops.*

7. Did you use the Icing Type product? If so, would you rate it as having value? How is Icing Type important for dispatch operations? (Note: Was rated as having value by a majority of users.)

   - *Type not important as existence; use PIREPs to determine type; intensity more important.*
   - *Type is important, but get from PIREPs and company reports.*
   - *Type is not important.*
   - *Type not important as existence.*
   - *Type is a consideration; obtained from PIREPs; severity from PIREPs is useful.*
   - *Type not important; ice is ice.*
   - *Type not important as existence, especially for 328s.*

8. In accessing bases and tops (e.g., Icing Bases and Icing Tops), which component (plan view or cross-section) is most useful?

   - *Cross section; gives all information at quick glance; when have icing will be running behind.*
   - *Cross section for all IIDA products.*
   - *Cross section used.*
   - *Cross section.*
   - *Cross section.*
   - *Cross section; take-off and climb phase is critical, if can do "non-ice" then is good.*
   - *Cross section; interested in specific routes, not national picture.*

9. Did you use any of the SLD products? If so, would you rate any of them as having value? Is SLD information important for dispatch operations? If so, how?

   - *Not used; may be useful.*
   - *Equate SLD with severity.*
   - *Not used much, but should keep as option.*
   - *If route shows SLD would look for PIREPs to confirm or not; would reroute if exists.*
   - *Not used as much as Icing Potential; may sway a decision one way or another.*
   - *Used SLD for severity; became more aware after training.*
   - *Not used; could eliminate SLD and Visible Moisture.*

10. Baseline information indicated that SIGMETs were a primary source of icing information. However, use and ratings were not high? Could you comment?

    - *SIGMETs are used to indicate movement; experience level may dictate use.*
    - *Convective SIGMETs used in summer, believes not intended for other phenomena; AIRMETs used for icing information.*
    - *Is time consuming to plot and read; use is dependent upon workload.*
    - *SIGMETs are first step for icing awareness, then cross section and PIREPs.*
    - *Use graphical SIGMETs off of ADF web page; Kavouras only provides text.*
    - *AIRMETs are too general; SIGMETs are in response to actual PIREP rather than a forecast.*
    - *SIGMETs are an approved source, but is an old way of doing things.*

11. Which display is preferred?

- *Prefers new.*
- *Prefers new.*
- *Prefers new; bigger is better; can read from a distance.*
- *More familiar with original interface.*
- *Prefers new; better organization.*
- *Prefers new; bigger is better.*
- *Prefers new; larger.*

12. There has been some possible confusion concerning the red color coding of areas of high potential being interpreted as intensity. How could this confusion be alleviated?

- *There is confusion; show potential with severity.*
- *Training alleviated confusion; but presentation could be confused with intensity.*
- *Reminds self that is looking at potential; color coding is meaningful.*
- *Definite problem; confuses with radar color scale where is red is high intensity; use hatch marks similar to Sig Weather Charts.*

13. Please identify any enhancements and improvements.

- *Improve accuracy, especially with clouds; PIREPs with plots rather than on different screens.*
- *Need to select deviations from routes, user selected routes.*
- *Animation over time to indicate movement and tendency.*
- *Make time jump out to avoid looking at old data; automatic updates.*
- *Don't use fire hydrant approach; limit data to what is there; don't add new items.*
- *Faster updates; weather changes rapidly in mountainous areas, have 3-4 flights per hour.*

Interview Questions and Responses for Atlantic Coast Airlines

1. Although IIDA information cannot be a source for go – no go decisions, was IIDA used in flight planning? If so, how was it used (e.g., take-off weight, routing)? Is the product more useful during a specific phase of flight?

   - *Product gives cursory overview, PIREPs on IIDA display give immediate notification of where icing is occurring, situational awareness, very valuable for rerouting.*
   - *Looked at TAFs and METARs, used IIDA Icing Potential as confirmation, graphical tool is good to have, is another tool. Vertical cross section is helpful.*
   - *Was used for "cities of the day" provided by NCAR, was used as a confirmation.*
   - *Gives indication of whether extra fuel will be needed, enroute used the most.*
   - *It's valuable. I look at it at the beginning of my shift to see what's forecast. Gives me an overview. Then look at an approved source. On IIDA product I look at Icing Potential, PIREPS and the ADDS page to pinpoint where icing will occur – then will confirm this information with an approved source.*
   - *Not used for planning unless sending no-ice aircraft. Not used for sending into icing conditions since it is not approved. It's another source to confirm what other information is telling me. Use mostly enroute via vertical cross section (VCS) component for an icing picture. Good because it gives a quick look.*

2. Do you release a flight non-icing (and conversely with icing limits)?

   a. Does IIDA information assist with this planning?
   b. Is it important to know where icing isn't occurring?

   - *Aircraft are released no-ice due to mechanical problems (can not encounter icing), is a judgement call based upon METARs, IIDA graphics were helpful.*
   - *Useful for aircraft that are restricted from flying into icing.*
   - *Have not used to know where icing isn't but would be good for rerouting around icing.*

3. Do you perceive IIDA as contributing to flight safety? If so, how?

   - *Definitely, in the winter flight into icing conditions occurs a lot.*
   - *Still viewed as a new, developmental tool, is cautious until confidence is gained.*
   - *Yes, would like to have IIDA brought on-line for all airlines to use, can not have too much information. Forecast of icing is useful.*
   - *Yes, there is an overall benefit to safety. If IIDA were approved, it would be a more valuable source. On a bad icing day it's very helpful in giving a quick look to what's going on (with icing). Other information sources are too time consuming.*
   - *Yes, it would probably enhance safety if I could use it to make decisions – if it were an approved source.*

4. How do you perceive the accuracy of the individual IIDA products in identifying or not identifying icing conditions? What is the accuracy measured against?

   - *Appears to be accurate measured against PIREPs, temperature aloft, company PIREPs.*
   - *Accurate to a point, feels that is below 75%.*
   - *Appears to be about 95% accurate when icing exists based on company PIREPs.*
   - *Company PIREPs seem to confirm, appears accurate.*
   - *Very accurate. If approved it would be my primary source of icing information.*
   - *PIREPs have confirmed the accuracy of the Icing Potential component on the VCS. It sometimes over-detects which I recall happening twice. On IIDA, generally only use the VCS; very good for monitoring specific flights.*

5. Of all icing information sources available, which do you find most valuable/useful? Why? (Text PIREPs were rated as having highest value)

   - *IR satellite was useful, Icing potential.*
   - *Vertical cross section is most beneficial, allows cutting of a slice.*
   - *Text data – PIREPs, temperature aloft, radar with snow and rain on ASD.*
   - *PIREPs are most useful.*
   - *PIREPs most useful source of icing information.*
   - *PIREPs most important/valuable source.*

   a. Which IIDA product did you use most or find most useful? Why and how was it used?

      - *PIREPs are most valuable, are on-time and in-conditions, radar and METARs.*
      - *Enroute is most beneficial, cross section, looking at "colors, altitudes, and location," Icing Potential.*
      - *Icing Potential on the VCS.*
      - *Icing Potential on the VCS*

   b. If Icing Bases and Tops were used, which IIDA component were they accessed from (i.e. vertical cross sections, bases and tops menus)

      - *Bases and Tops used often to give dispatchers an assessment of icing, used routes.*
      - *Start out general then go route-specific, tend to look at cross sections.*
      - *Cross sections, would like to customize routes.*
      - *Used both national and route-specific, bases and tops from cross section.*
      - *Icing Bases and Tops not used, but will look at Icing Bases on the VCS.*
      - *If Icing Bases are used, accessed from the VCS.*

c. Did you use the freezing rain component? Log data rated this component very highly. Can you explain?

- *Is helpful.*
- *Use for surface phenomena, had case last month with surface freezing rain at RDU.*
- *Have not used much, on days when need the most do not have time to look at various products.*
- *Not used.*
- *Occasionally uses freezing rain component – good to have and should use it more.*
- *Freezing rain is used occasionally when I first go on shift.*

d. Did you use the Visible Moisture component? If so, how was it used? This too reportedly had high usage and was rated positively. If used, did you find it accurate?

- *Is helpful from a legality standpoint.*
- *Haven't looked at.*
- *Used, enables look to see potential combined with temperature aloft.*
- *Not used.*
- *Visible Moisture used time to time. Especially helpful in determining whether to send icing or non-icing.*
- *Have looked at and used Visible Moisture component. Find it to be accurate.*

e. Did you use the Icing Type component ? Is icing type information important to dispatch operations?

- *Is used.*
- *Type is important, clear is most dangerous, IIDA doesn't give clear separation between types, uses PIREPs to determine type.*
- *Types are important, PIREPs are used, size of letters on IIDA are useful, looks at Icing Type also, then looks at text to see aircraft type.*
- *Type is important, get from PIREPs, has not seen Icing Type on IIDA.*
- *Don't use IIDA Icing Type. Get that information from PIREPS – although type is important – as well as severity which is obtained from PIREPs. PIREPs give more information.*

f. Did you use any of the SLD products? If so, were they of any value to you? Is SLD information important for dispatch operations? If so, how?

- *Is related to icing associated with thunderstorms, large drops with thunderstorms lead to clear icing, not believed to be useful during winter except in the southeast.*
- *Did not use.*
- *Good for determining potential for picking up icing, good for top information, ASD has echo tops sometimes.*
- *Not used, could be useful.*
- *Uses SLD component to pinpoint icing – where icing intensity exists.*
- *SLD rarely used. Doesn't tell me much.*

6. Baseline information indicated that SIGMETs and AIRMETs were a primary source of icing information. However, use and ratings were not high. Could you comment?

   - *Have a graphical display provided by WSI, SIGMETs and AIRMETs are used if plotted.*
   - *AIRMETs are for GA which are unprotected, concerned with Convective SIGMETs.*
   - *Cover such a wide area that usefulness is diminished, don't really use AIRMETs and SIGMETs for icing, would like to see IIDA become the standard for airline use.*
   - *SIGMETs don't come up automatically, if want to look at have to take extra steps.*
   - *Uses SIGMETs more than AIRMETs. These are not a major consideration – mostly for GA traffic. Mostly use PIREPs on ADDS page (not on IIDA). Accessing PIREPs in IIDA is cumbersome and time consuming. The graphical PIREPs on the IIDA display are difficult to differentiate.*
   - *AIRMETs and SIGMETs are one of my primary sources of icing information. However, mostly look at PIREPs for icing information.*

7. There has been some possible confusion concerning the red color coding of areas of high potential being interpreted as intensity. How could this confusion be alleviated?

   - *Use a percentage to relay to pilots.*
   - *Red is used like a stop sign warning – draws attention.*
   - *Assumption is that is similar to radar – red is higher intensity, overcome with use and training.*
   - *When see red areas, look and call for PIREPs.*
   - *Could be confusing although differentiation is not problem. Looks like radar depictions. Maybe changing the color to colors used in infrared satellite would help.*
   - *Sometimes confused and think red indicates intensity.*

8. Which display (main page) is preferred?

   - *New display was being used.*
   - *Used old display due to familiarity.*
   - *New interface is preferred since is tighter and neater.*
   - *Has had team leads call up products.*
   - *Prefers new interface.*
   - *Prefers new interface.*

9. Please identify any enhancements.

   - *None identified.*
   - *Put lesser used items in separate menu, different products at different levels (e.g., radar), have to become familiar with product before can easily evaluate.*
   - *Click to zoom or drag box for all screens, more routes, more cities with progressive disclosure as zoom in.*
   - *None identified, would have to go through all products to identify any.*
   - *Improve depiction of PIREPs – they take too long to interpret – allow textual PIREP to appear when you click on graphical one. Animation. Improve menu layout. Improve linking and navigation.*
   - *Only wants a product that's simple and quick. Would like to be able to click on PIREPs and get text read-out.*

APPENDIX D

FINAL QUESTIONNAIRE

IIDA Regional Airline Dispatcher Questionnaire

This form has been prepared for dispatchers at Atlantic Coast Airlines and Air Wisconsin Airlines in order to obtain feedback on the Integrated Icing Diagnostic Algorithm (IIDA). Please respond to all questions as honestly and thoroughly as you can.

Responses to this form will remain ANONYMOUS and CONFIDENTIAL. A report will be written on the results of this form, summarizing respondents' comments; however, no one will be identified or associated with any specific comment.

Please provide the following information:

Name (Optional): _____

Title: _____

Airline: Air Wisconsin ❍ Atlantic Coast ❍

Dispatch Position (Choose the appropriate box(es) for your primary position):

❒ CRJ
❒ J41
❒ J32
❒ 328
❒ 146
❒ Coordinator
❒ Team Leader
❒ Other (please identify) _____

Part 1 - IIDA COMPONENT RANKING

Instructions: Please look at all of the following main IIDA components and rank order them from most useful to least useful, with "1" indicating the highest usefulness, to "10" indicating the lowest. Do not use the same number more than once.

	Icing Potential
	SLD Potential
	Icing Type
	Icing Bases
	Icing Tops
	SLD Bases
	SLD Tops
	Cloud Tops
	Cloud Bases
	Visible Moisture

Comments:

Part 2 - IIDA COMPONENT RATINGS

IIDA provides the user with many components relevant to icing conditions. Much of this information is unique to IIDA, such as Icing/SLD Potential, Icing Type, and Icing Bases and Tops. However, some of the information can be obtained from other sources, e.g., vendor supplied radar and weather products and other Internet sources such as the Airline Dispatchers Federation web page. To develop an icing product that will meet the needs of the aviation dispatcher community, it is important to know which IIDA components provide benefit or use.

Instructions: Please rate each IIDA component based on the following criteria:

Highly desirable: The IIDA component is **extremely useful** in providing information relevant to icing conditions and is beneficial to dispatch operations.

Desirable: The IIDA component is **useful** in providing information relevant to icing conditions and is somewhat beneficial to dispatch operations.

Neutral: The IIDA component is **neither** useful nor non-useful in providing information relevant to icing conditions and has no effect on dispatch operations.

Not desirable: The IIDA component is **not useful** in providing information relevant to icing conditions and provides no benefit to dispatch operations.

Highly undesirable: The IIDA component is **not at all useful** in providing information relevant to icing conditions and may be detrimental to dispatch operations.

Not used: The IIDA component was **not used.**

	Highly Desirable	Desirable	Neutral	Not Desirable	Highly Desirable	Not Used
IIDA Products:						
Composite Icing Potential (National View)	❍	❍	❍	❍	❍	❍
Icing Potential at 3000' Intervals	❍	❍	❍	❍	❍	❍
Composite SLD Potential (National View)	❍	❍	❍	❍	❍	❍
SLD at 3000' Intervals	❍	❍	❍	❍	❍	❍

	Highly Desirable	Desirable	Neutral	Not Desirable	Highly Desirable	Not Used
Vertical Cross Sections (route specific)						
- Icing Potential	❍	❍	❍	❍	❍	❍
- SLD Potential	❍	❍	❍	❍	❍	❍
- Visible Moisture	❍	❍	❍	❍	❍	❍
Icing Type at 3000' Intervals	❍	❍	❍	❍	❍	❍
Icing Tops	❍	❍	❍	❍	❍	❍
Icing Bases	❍	❍	❍	❍	❍	❍
SLD Tops	❍	❍	❍	❍	❍	❍
SLD Bases	❍	❍	❍	❍	❍	❍
Cloud Tops	❍	❍	❍	❍	❍	❍
Cloud Bases	❍	❍	❍	❍	❍	❍
PIREPs (graphical)	❍	❍	❍	❍	❍	❍
Infrared Satellite	❍	❍	❍	❍	❍	❍
Visible Satellite	❍	❍	❍	❍	❍	❍
National Radar Mosaic	❍	❍	❍	❍	❍	❍
Areas of Any Precipitation	❍	❍	❍	❍	❍	❍
Areas of Snow	❍	❍	❍	❍	❍	❍
Areas of Freezing Precipitation	❍	❍	❍	❍	❍	❍
Surface Observations and Forecasts						
- TAFs	❍	❍	❍	❍	❍	❍
- NWS Local Forecast	❍	❍	❍	❍	❍	❍
- METARs	❍	❍	❍	❍	❍	❍

Part 3 - USER INTERFACE

The user interface (the display characteristics that affect how the user interacts with a system or display) can influence how the user accesses, interprets and uses the information the product provides. These characteristics may include, but are not limited to, acceptable use of colors, ease of navigation, readability of graphics and text, and interpretability of information displayed.

Instructions: In order to evaluate the acceptability of the IIDA user interface, please read each of the statements below and indicate the degree you agree or disagree with each of the statements. Please include any additional comments or examples you may have related to any of the statements.

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree	NA
Colors indicating scale gradations are easy to differentiate from one another (e.g., different shades for Icing Potential values can be delineated).						
Response	❍	❍	❍	❍	❍	❍
Comment:						
The color red, indicating higher Icing or SLD Potential, is not confused with icing severity or intensity.						
Response	❍	❍	❍	❍	❍	❍
Comment:						
On the main product display, menu items are grouped meaningfully and are easy to access.						
Response	❍	❍	❍	❍	❍	❍
Comment:						
Textual annotations and abbreviations such as station identifiers and weather abbreviations (e.g., ZL, ZR, PE, SLD) are easily understood and require no explanation or interpretation.						
Response	❍	❍	❍	❍	❍	❍
Comment:						
It is easy to navigate back and forth between displays and products.						
Response	❍	❍	❍	❍	❍	❍
Comment:						
Product "Help" information provides assistance in using the different IIDA products.						
Response	❍	❍	❍	❍	❍	❍
Comment:						
Additional Comments:						

Part 4 - PRODUCT USEFULNESS FOR JOB TASKS

Instructions: The below should be used to rate the usefulness of IIDA for each of the tasks listed. Please refer to the following definitions when responding.

Of Considerable Use: IIDA had a significant positive effect on planning and activities related to the performance of this task.

Somewhat Useful: IIDA had a positive effect on planning and activities related to the performance of the task.

Borderline: IIDA had little to no effect on planning and activities related to the performance of the task.

Of Little Use: IIDA had a negative effect on planning and activities related to the performance of the task.

Of No Use: IIDA had a significant negative effect on planning and activities related to the performance of the task.

Not Used: You have not used IIDA in performing this task.

	Of Considerable Use	Somewhat Useful	Borderline	Of Little Use	Of No Use	Not Used
Planning fuel quantity	❍	❍	❍	❍	❍	❍
Planning flight route	❍	❍	❍	❍	❍	❍
Selecting altitude	❍	❍	❍	❍	❍	❍
Avoidance of icing areas	❍	❍	❍	❍	❍	❍
Monitoring flight conditions	❍	❍	❍	❍	❍	❍
Re-routing flights	❍	❍	❍	❍	❍	❍
Advising pilots enroute of potential icing conditions	❍	❍	❍	❍	❍	❍
Other: _____	❍	❍	❍	❍	❍	❍
Comments:						

Part 5 - POTENTIAL ENHANCEMENTS

Instructions: Please read the following potential IIDA enhancements and rank each one on a scale from 1 to 8, with "1" indicating greatest importance to "8" indicating least importance. Do not use the same number more than once.

	Animation/looping
	Icing Forecast Indicate preferred forecast duration: ___ hr(s)
	Indication of icing intensity/severity
	User selected zoom capability
	User selectable routes for cross sections
	Display of icing PIREP text when clicking on graphical PIREP
	Automatic product updates
	Additional user selected overlays (check all that apply) ❒ VORs ❒ Lat/Long ❒ Arrival/Departure Gates ❒ Other: _____

Part 6 - ADDITIONAL COMMENTS

Instructions: In the space below, please include any additional comments or suggestions for IIDA improvements.

Thank you for your responses! If you have any questions about this form please contact either danny.sims@tc.faa.gov or cynthia.CTR.fidalgo@tc.faa.gov.

Submit Form | Reset Form

APPENDIX E

USER LOG RESPONSES

User Log Product Ratings (Responses to Question 6)
Air Wisconsin and Atlantic Coast Airlines

Product/Source	Median	N
Voice PIREPs	4.5	12
Freezing Precipitation	4	12
Icing Bases	4	14
Graphical PIREPs	4	14
Visible Moisture	4	15
Icing Potential	4	22
Icing Tops	4	17
All Snow Precipitation	4	11
Text PIREPs	4	14
Temperatures Aloft	4	13
SLD Tops	4	12
Icing Type	4	17
Radar	4	15
Any Precipitation	4	13
Cloud Tops	4	13
Cloud Bases	4	13
SLD Bases	4	12
SLD Potential	4	15
TAFs	3.75	16
SIGMETs	3	11
METARs	3	15
Visible Satellite	3	13
Infrared Satellite	3	11
Area Forecasts (FAs)	3	12
AIRMETs	3	17

Products were rated using the following scale. See the User Log in Appendix B for a full description of the rating scale.

0 = Not used
1 = No value
2 = Little value
3 = Neutral
4 = Value
5 = High value

User Log Product Ratings (Responses to Question 6)
Air Wisconsin Airlines

Product/Source	Median	N
All Snow Precipitation	4	10
Visible Moisture	4	6
Voice PIREPs	4	4
Any Precipitation	4	5
Temperatures Aloft	4	3
Freezing Precipitation	4	4
Graphical PIREPs	4	6
Cloud Bases	4	4
Cloud Tops	4	4
Icing Potential	4	12
Icing Type	4	7
Radar	4	5
Icing Bases	4	4
Icing Tops	4	7
SLD Tops	4	3
Text PIREPs	4	5
SIGMETs	3.5	2
TAFs	3.5	6
METARs	3	5
FAs	3	3
SLD Bases	3	3
SLD Potential	3	6
Visible Satellite	3	5
Infrared Satellite	3	3
AIRMETs	3	8

Products were rated using the following scale. See the User Log in Appendix B for a full description of the rating scale.

0 = Not used
1 = No value
2 = Little value
3 = Neutral
4 = Value
5 = High value

User Log Product Ratings (Responses to Question 6)
Atlantic Coast Airlines

Product/Source	Median	N
Voice PIREPs	5	8
Text PIREPs	5	9
Freezing Precipitation	4.5	8
Icing Tops	4	10
Icing Bases	4	10
Icing Potential	4	10
Graphical PIREPs	4	8
Visible Moisture	4	9
SLD Tops	4	9
Icing Type	4	10
Radar	4	10
Temperatures Aloft	4	10
SLD Bases	4	9
All Snow Precipitation	4	8
Any Precipitation	4	8
SLD Potential	4	9
Visible Satellite	4	8
TAFs	3.75	10
Cloud Tops	3.5	9
Cloud Bases	3.5	9
Infrared Satellite	3.5	8
METARs	3.5	10
SIGMETs	3	9
FAs	3	9
AIRMETs	3	9

Products were rated using the following scale. See the User Log in Appendix B for a full description of the rating scale.

0 = Not used
1 = No value
2 = Little value
3 = Neutral
4 = Value
5 = High value

User Log Comments

Question 3: Comment on today's performance of IIDA in identifying in-flight icing; including geographical location, altitude, icing reports, intensity, type, and specific IIDA products referenced.
IIDA seem to work and update just fine today. due to the weather being mostly clear out west I didn't use it much this shift
Icing reports = two PIREPs today and yesterday...
IIDA WAS VALUABLE FOR MOST EVERY FLIGHT.
Seemed to be quite accurate
No PIREPs of any icing
Product used for flight planning purposes, Enabled us to notify flights of possible Icing Conditions. PIREPs concur with Icing Product info. Company PIREPs also concur with Icing Product Info.
Was able to predict GJT & GUC Icing conditions with the use of the Icing Product...Right after I started receiving PIREPs and phone calls ref. Next flights, to be sent via Drift Down Icing conditions...
Pretty much on target. coincided with PIREPs.
TODAY EVERYTHING WENT WELL. I USED THE PRODUCT TO HELP PLAN WEATHER ALONG THE ROUTE.
IIDA used only as visual aid today...High Pressure dominates the Colorado areas...
Operated and updated accordingly
Compared PIREPs with icing potential in ORD area which seemed to correlate well
IIDA clearly showed the progression of icing conditions as they moved across the state of CO during the shift. A larger than normal number of PIREPs confirmed the conditions, most showed in the red areas on the plan view and cross sections, though I noticed a couple of reports showing up between areas of red, within a blue area.
Yesterday 1/16/98 we did not use any IIDA products with the exception of the PIREP display. All the other functions were not updating.
Weather did not really require the use of IIDA today. I did look at the maps plotting pilot reports for icing.
Looks good
Seemed to work ok
Appears to be accurate - no reports of icing.
Due to a lack of PIREP from company pilots unable to determine.
Seemed to be fairly accurate
AWI 132 MTJ-DEN reported clouds MTJ-GUC FL140-150 tops at FL220 clear above, negative icing. IIDA showed a 80-90 percent probability of icing sfc to about FL180.
Product was not used today. wx vfr.
Today, it's stuck on 17z from yesterday
I've received a PIREP from a J31 coming from SCE to IAD, reporting rime ice between 12 and 14 thousand feet. After reviewing the icing page on the PA area, I noticed few PIREPs of rime icing. I informed the captain of the flight asking him to confirm if he encounters any type of icing. Coming back from SCE, captain reported moderate rime icing over MDT. He commented that he was expecting it based on the PIREPs that where available.
Today was a very light day for icing. Nothing much to report

Question 3 (continued):
IIDA showed icing diminishing in the northern Vermont area as the day went on. This was confirmed by PIREPs from our crews.
Today the weather in the Atlantic east coast is warmer than normal and clear skies. IIDA has slightly to none chances of icing in the north east. Couple of PIREPs over the New York area agree with the forecast of clear skies and no sign of icing.
IIDA was accurate in portraying the in-flight icing conditions on the ORD-FSD flight. We received a PIREP from that flight. They described no icing east of MSN and as they descended through 10000 ft into FSD they encountered slight rime icing.
Today there a slim chance of icing on the north eastern side. A recent PIREP from one of our Jetstream 31 flying over HPN at 14000 feet reported sky clear. This report agrees with the forecast on the icing page of slim to none possibility of icing on that area.
The IIDA was accurate in reporting no icing
OPERATING IN THE NORTH EAST ON THE 15TH OF FEB. THE ICING IS MINIMAL I LOOKED AT THE DIFFERENT ALTITUDE CHARTS AND CHECKED FOR PIREPS
The CRJ dispatcher and I referenced the Cross-section Icing Potential, SLD Potential, and Vis Moisture charts when dispatching a flight from ORD to FSD. The flight departed ORD at approx 1630Z. At 1700Z, the Captain of this flight gave us a PIREP stating that no icing was encountered from climb out to FL230. FL230 at PLL VOR which is approx 100 nm west of ORD is the location of this PIREP.
FOR THE DTW AREA THE ICING PROGRAM MATCHED UP WITH WHAT A PIREP FROM A J41 CREW CALLED IN.
VERY BENEFICIAL. PERFORMANCE VERY ACCURATE IN ALL RESPECTS.
PIREPS OUT OF IAD, CLE, AND BGM THAT APPEAR TO BE VERY CLOSE TO WHAT HAS BEEN REPORTED THROUGH IIDA
ORD-FSD FLT 7802: NO ICING CONDITIONS REPORTED. A/C LANDED AT 1640Z. BLOWING SNOW WAS ENCOUNTERED ON APPROACH.
Today the IIDA is showing an accurate representation of the icing conditions in the eastern US.

Question 4: Comment how IIDA affected any of the above functions (flight release preparation, fuel and or load capacity planning, routing planning, other):
It is necessary to increase fuel burns if acft is going to be in icing for any length of time.
Used for determination of whether or not to use a drift-down route or a TCA route...
Combined with satellite graphics...we were able to determine routes which could be released non-icing.
Used IIDA as one of several sources to predict icing
Allowed all flights to be dispatched with prior info. ref: ICING CONDITIONS
Affected all of the above and was used on all flights going across the mountains today. Flights to the North were sent non-icing
Lowered max take off weights.
All flights sent non-icing today...IIDA used only as a visual ref. today...
Spent some time on this shift familiarizing myself with the products
Several hours into the shift, I noticed that the Flight View program was displaying precip around the HDN area. This was not confirmed by surface observations though. I checked the IIDA cross section, and it also showed a high potential for icing. Available satellite graphics did not clearly show any cloud layers, but the decision was made to start releasing using icing limits. This proved to be the correct decision as the shift went on, and PIREPs began to confirm that icing was indeed present.
All day, flights were dispatched into icing conditions. IIDA was only used a couple of times as conditions were not changing much.
IIDA was used to evaluate icing potential at the start of the day.
This is my first full shift working the D328 solo. Because of the performance penalties imposed on this airplane knowing the potential for icing becomes not only an operational but economic issue.
Was used to brief myself on current conditions at the start of my shift.
A brief description of icing potential added to a number of releases. No comments from flight crew members as yet.
A DEN-JAC flight was overbooked and I had planned the release using cycle ice numbers which created a weight restriction problem. The Captain called and upon further review of the current weather situation, including use of the IIDA route view and graphic PIREP display, the Captain and I were able to determine that icing conditions were not likely for this route of flight and I re-released his flight using non icing numbers.
Referencing information to see if info concurs with reports being issued for given areas. Get an idea of flow and potential of icing conditions
We added 200 lb to the min fuel just in case the plane had to do some vectoring due to the possible icing in route.
We are only authorized to use as reference only at this time
Today icing is not in effect so we dispatch and fuel plan accordingly.
A plane went on maintenance with a prop heat inop. Its next round was IAD-RIC-IAD. After reviewing the existing forecast and comparing it to the icing page forecast, dispatch decided that the aircraft was suitable to fly on that particular round.
KNEW THAT MOST OF OUR ROUTES WOULD BE NOT AFFECTED WITH THE HIGH PRESSURE SYSTEM THAT IS IN PLACE TODAY
Very useful in weighing alternatives to standard flight plan options.

Question 4 (continued):
CHECKING TO SEE IF WHAT IT WAS CALLING FOR MATCHED WHAT REALLY WAS OCCURING
NO AFFECT TODAY.

Question 5: Did IIDA add anything to your knowledge of today's icing situation that could not be readily perceived from other information sources, such as PIREPs or AIRMETs?
Wx was for the most part clear, initial briefing showed low probability of icing
Potential Icing
Altitudes for the tops of icing conditions graphically displayed route specific was helpful
Propensity for icing along selected routes
PIREPs matched the DEN 1830 PIREPs I received from company. When I checked the GJT and GUC wx against the Icing Product, it was right on the money. This enabled me to send all flights out of the Mountains restricted due to icing. PIREPs received from Company were exactly what the Product showed. We had a heads up because of the Icing Product...
IT GAVE A CLEARER PICTURE OF WHERE THE ICING IS ALONG THE ROUTE.
Mostly clear skies in the COLORADO AREA TODAY...
As usual, AIRMETs tended to overforecast the area of icing
It showed potential icing prior to any PIREPs being received. Also the graphic display of PIREPs was much more useful than our normal text display. I was able to see the areas where PIREPs had been issued, and then get more details from the textual display.
The pilot report plotting charts allow you to be able to search for the full text PIREP in a much more effective and efficient manner.
I am not sure it added anything that could not have been found elsewhere but IIDA provides a consolidated snapshot of numerous products at one time. This makes IIDA an excellent tool and an efficient one.
Yes, the graphics are easier and faster to read
Because it's not working today
There was an AIRMET for icing out which covered nearly all of the state of WY. However, there were no icing PIREPs and the IIDA showed a low potential for icing over the DEN-JAC route.
IIDA confirmed that no icing conditions existed.
Information on where, in a 3D image where and when a particular area is susceptible to icing conditions
Made me aware of the possibility of icing on that particular area and based on that I added extra contingency fuel in case of possible deviation from the original flight plan due to icing.
It gives an easier to understand, graphical interpretation of the icing situation.
Not much weather in effect for the Atlantic east coast.
I believe it gave an accurate model for the dispatcher to predict the position for the ice.
It showed the icing approaching the outer edge of our system.
MORE SO ON DAYS WITH MORE ICING POTENTIAL
QUICK AND EASY ACCESS.
Mainly it gives the dispatchers a better representation of the potential icing by giving both a vertical and horizontal picture of the potentials.

Question 7: Please provide any additional comments:
Product is working and updating on the hour O.K. Thanks for it's use...
Found the satellite page at: http://www.rap.ucar.edu/weather/satellite/latest_DEN.jpg to be more useful than the national satellite linked to the IIDA page. Also discovered that the PIREPs displayed on IIDA were more timely than the text PIREPs from our Kavouras direct line computer. However, I think it would be helpful to have the PIREP text available from the IIDA page.
GUC WX @ 1653Z SHOWING 01006KG 10SM FEW075 BKN150 BKN250 07/06 A2983 Crew advised DSP of low cig. This was what the ICING PRODUCT SHOWED ALSO. Although WX WAS showing 10SM...Thanks
This Icing site used in conjunction with other weather sources, enabled us to send flights at a greater safety level...
My use of the products has not been extensive. Trying to find time to take advantage of the products.
Perhaps a graphic loop could be developed using recent data which could help icing predictions. A loop similar to radar loop would be very helpful in visualizing potential icing conditions as areas develop, degrade and move.
Once again, the graphical PIREPs were updating faster than our Kavouras text PIREPs.
We use this every day, so on the days it's unavailable, we miss it. However, it is Sunday. Have a nice day.
Include severity of icing on the vertical displays, to help cut down on confusion of severity
Very accurate report on icing conditions.
I use this product frequently to prepare myself for a shift and to confirm information I have been given. The most valuable information I find are the graphics. I can easily see what's going on in the ACA system or bring up a particular route to find how much ice is out there. In short, what I can find fast and easy is good information.
THIS PRODUCT IS VERY VALUABLE ON DAYS WITH HIGH ICING POTENTIAL IN DETERMINING WHAT ALTITUDE TO FILE AT.

APPENDIX F

FINAL QUESTIONNAIRE RESPONSES

IIDA Component Ratings
IIDA Final Questionnaire (Responses to Part 2)

Product	Median	N
Vertical Cross Section - Icing Potential	1	16
Areas of Freezing Precipitation	1	17
PIREPs (graphical)	1	17
METARs	1	15
Icing Bases	1.5	16
Visible Satellite	1.5	16
Vertical Cross Section - Visible Moisture	2	15
Composite Icing Potential	2	17
Vertical Cross Section - SLD Potential	2	15
Icing Tops	2	16
Areas of Any Precipitation	2	17
Icing Potential at 3000' Intervals	2	17
TAFs	2	15
SLD at 3000' Intervals	2	16
Icing Type at 3000' Intervals	2	16
Cloud Tops	2	17
Cloud Bases	2	17
Infrared Satellite	2	17
Areas of Snow	2	17
Composite SLD Potential	2	17
SLD Bases	2	16
SLD Tops	2	16
NWS Local Forecasts	2	15
National Radar Mosaic	2	16

Products were rated using the following scale. See the Final Questionnaire in Appendix D for a full description of the rating scale.

0 = Not Used
1 = Highly Desirable
2 = Desirable
3 = Neutral
4 = Not Desirable
5 = Highly Undesirable

User Interface Issues
IIDA Final Questionnaire (Responses to Part 3)

Rating Scores:

Interface Component	Median	N
Color scale gradations are easy to differentiate	2	15
Red is not confused with icing severity or intensity	2	15
Menu items are grouped meaningfully	2	15
Annotations and abbreviations are easily understood	2	15
Easy to navigate between displays and products	2	14
Product "help" information provides assistance	2.5	10

Interface issues were rated using the following scale. See the Final Questionnaire in Appendix D for a full description of the issues.

0 = NA
1 = Strongly Agree
2 = Agree
3 = Neither Agree Nor Disagree
4 = Disagree
5 = Strongly Disagree

Comments: Comments for each of the user interface issues and any additional comments are in the following tables.

Colors indicating scale gradations are easy to differentiate from one another.
Did not use the product enough to have a confident selection for answer (this comment is for all the following comments to follow).
The choice of colors strongly emphasized and supported the delineation of each value.
It was a bit difficult to differentiate between the reds and the mid range blues.

The color red is not confused with icing severity or intensity.
At first it was viewed as intensity but after getting into the product, it was no problem to view the colors as the potential, and not intensity of icing.
The color red, due to it's relationship on radar pictures, tends to lead people into an intensity mindframe.
I think the potentiality of icing conditions correlating with the graduated scale needs to be explained in layman's terms. This will assist in interpretation.
Often need to remind users that the scale only indicates possibility of icing to exist not intensity.
This confusion I believe was caused by comparison to the color radar intensity scales. The continuing visits by the development team help straighten this out quickly.
Would be helpful to get icing severity and/or intensity with a click in the route already looking at.

Menu items are grouped meaningfully and are easy to access.
The only suggestion that I have is that maybe the route screen could be a little larger...be able to click on the desired route .....it's kinda small.
After the "Second " page was issued it became more user friendly. It would have been nice to have the ability to zoom in on a region, or have all of our cities displayed on the page.

Textual annotations and abbreviations are easily understood and require no explanation or interpretation.
Maybe a pop-up screen could be incorporated into the program so when the user places the cursor over the identifier, either a pop-up box would come up and define the abbreviation, or it could be displayed in a message box within the border of the page.
Some of the colors used tend to blend into the background, hopefully colors with high contrast can be used.

Help Comments
Never used.
Some concepts were a little beyond a layman's grasp for interpretation of the product.

User Interface Additional Comments
The PIREP symbols could be improved to be more easily read and understood.
I believe IIDA will be a very useful tool for expanding the scope of how a dispatcher determines icing conditions.

Product Usefulness for Job Tasks
IIDA Final Questionnaire (Responses to Part 4)

Rating Scores:

Task	Median	N
Advising pilots enroute of potential icing conditions.	1	16
Avoidance of icing areas.	1	15
Planning flight route.	1	15
Re-routing flights.	1	16
Selecting altitude.	1	16
Monitoring flight conditions.	1.5	16
Planning fuel quantity.	2	14

The usefulness of IIDA for each task was rated using the following scale. See the Final Questionnaire in Appendix D for a full description of the rating scale.

0 = Not Used
1 = Of Considerable Use
2 = Somewhat Useful
3 = Borderline
4 = Of Little Use
5 = Of No Use

Comments:

I didn't use this product for planning of actual flights. I checked out what it had to offer.
The rating are a perceived usefulness. ACA did not use the product for actual decisions.
IIDA did not have a great impact on most of these areas during daily operations. If there was some icing potential enroute, I would be more inclined to up the fuel, but have never changed a flight route, or selected a different altitude for a flight. Our flights are not really long enough to make a reroute feasible. When icing conditions exist, they seem to cover a wide enough area, such that a reroute would not be feasible.

Additional Comments
IIDA Final Questionnaire (Responses to Part 6)

I have not used it on a one to one basis, mostly used information from team leaders who examined the product and advised me accordingly. Very helpful in planning for deice MEL equipment aircraft for swaps or reroutes.
The usage of this system was placed more heavily to the Team Leaders than the Dispatcher. Therefore the input that was entered was based on very little usage of the product.
This product proved to be very useful to me. I am sure that as more fine tuning is done to improve upon the product, it will become a viable tool to all dispatch centers. Thanks.
Overall I find the program to be very useful. I would like to see enhanced graphics with more defined lines and zoom capability. Overlay of prominent fixes, cities or airport would be especially helpful in locating where the icing conditions are relative to the route.
This product has been extremely useful to me as an Air Wisconsin Dispatcher during this winter season. Thank you for your assistance.
I THINK ANY ADDITIONAL INFO TO THIS PRODUCT WOULD BE GREAT. THIS HAS BEEN VERY GOOD IN ALL ASPECTS OF FLIGHT PLANS.
I believe IIDA's greatest value is in increasing the overall awareness(big picture). That along with current PIREPs make for a very useful product.
Had a situation when the icing profile indicated icing, but all PIREPs reported no clouds "clear and a million."
Product was helpful for some decision making, but its use was not as critical on the 146 desk.